THE MOLLUSCAN FAUNA OF THE PLIOCENE STRATA UNDERLYING THE ADELAIDE PLAINS

PART IV—GASTROPODA (TURRITELLIDAE TO STRUTHIOLARIIDAE)

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SUMMARY

Part IV of the study of the mollusca from borings into the Dry Creek Sands consists of a revision of the gastropod superfamilies Cerithiacea, Scalacea, Pyramidellacea, Hipponicacea, Calyptraeacea.

The nomenclature of 48 species has been revised, 1 new genus, 2 new subgenera and 16 new species have been described.

The occurrence of a very thin remnant of the Dry Creek Sands outcropping in the River Light is placed on record as the most northerly exposure of the Pliocene in the Adelaide Basin.

INTRODUCTION

Late in 1955, a very thin remnant of Pliocene calcareous sandstone overlying Oligo-Miocene yellow fossiliferous limestone was observed in an outlier at Redbands, on the River Light, 3½ miles east-south-east of Mallala, Section 5, Hundred of Grace. Although the total rock exposure is very small, an assemblage characteristic of the Dry Creek Sands has been identified from moulds, casts and chalky shell remains. Species include *Glycymeris convexa* (Tate), *Chlamys antiaustralis* (Tate), *Miltha hora* (Cotton), *Dentalium latesulcatum* Tate, *Turritella acricula adelaidensis* Cotton & Woods, *Diastoma provisi* Tate, *Thericium torri* (Tate), *Polinices substolida* (Tate), *Conus* (*Floraconus*) sp. nov.

Opportunity is taken of placing this occurrence on record as relevant to the present study. It extends considerably to the north the occurrence of the Pliocene Dry Creek Sands in the Basin.

The methods employed in describing the fauna have been outlined in Parts I (this Journal, vol. 77), II (vol. 78), and III (vol. 79). Part IV includes the Pyramidellacea, the systematic position of which is not yet firmly established. Modern zoologists tend to place them with the Opisthobranchia.

Superfamily CERITHIACEA

Family TURRITELLIDAE

Genus Turritella Lamarck, 1799

Turritella Lamarck, 1799, Mem. Soc. Hist. Nat. Paris, p. 74.

Type species (o.d.) *Turbo terebra* Linné

Subgenus Gazameda Iredale, 1924

Gazameda Iredale, 1924, Proc. Linn. Soc. N.S.W., 49 (3), 197, p. 247.

Type species (monotypy) *Turritella gunnii* Reeve

Turritella (Gazameda) acricula adelaidensis Cotton & Woods

Turritella (*Gazameda*) *acricula adelaidensis* Cotton & Woods, 1935, Rec. S. Aust. Mus., 5 (3), p. 376, text fig. 2.

Gazameda adelaidensis Cotton & Woods, Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.

Turritella (*Haustator*) *acricula adelaidensis* Cotton & Woods, Ludbrook, 1954, Trans. Roy. Soc. S. Aust., 77, p. 59.

Diagnosis—Acutely lanceolate, with turreted apex of 2 narrow convex turns, ephebic whorls smooth and sharply carinated at the middle. Adult whorls tending to uncoil with resultant deep excavation at the anterior suture. Sculpture very variable, rough, generally of about 12 subequal spiral threads, of which the medial 2 to 4 are the stronger and more widely spaced, and secondary interstitial spiral threads all crossed by medially arched growth axials of almost equal strength to the spirals, producing rhombic cancellation or punctation.

Dimensions—Height 37, diameter 7 mm.

Type Locality—Abattoirs Bore, Adelaide.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1681.

Observations—The species *acricula* (*sensu lato*) is very variable and it is difficult to decide whether *adelaidensis* should be separated from it specifically or subspecifically. *Adelaidensis* is generally more coarsely sculptured than *acricula* s. str., particularly in the strength of the axials and resultant cancellation. The early whorls are identical with those of *acricula*, and many specimens are inseparable from the typical species.

In the opinion of Dr. J. Marwick (personal communication) *Cazameda* should be separated from *Haustator* under which the writer listed the species (1954, p. 59).

Material—Numerous specimens Hindmarsh Bore, 28 specimens Weymouth's Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Adelaide District.

Turritella (Cazameda) subacricula Cotton & Woods

Turritella (*Cazameda*) *subacricula* Cotton & Woods, 1935, Rec. S. Aust. Mus., 5 (3), p. 376, text fig. 2.

Cazameda subacricula Cotton & Woods, Cotton, 1952, Geol. Surv. S. Aust. Bull., 27, appendix 4, p. 245.

Turritella (*Haustator*) *subacricula* Cotton & Woods, Ludbrook, 1954, Trans. Roy. Soc. S. Aust., 77, p. 59.

Diagnosis—Sharply turreted, whorls markedly convex, sculpture of 4 major spiral ribs and indistinct secondary ribs crossed by marked axial growth striae.

Dimensions—Height 40·5, diameter 7·8 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1686.

Material—4 incomplete specimens, Hindmarsh Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs and Hindmarsh Bores, Adelaide.

Subgenus Ctenocolpus Iredale, 1925

Ctenocolpus Iredale, 1925, Rec. Aust. Mus., 14, pp. 249, 266.

Type species (monotypy) *Turritella australis* Lamarck

Turritella (Ctenocolpus) trilix Cotton & Woods

Turritella (*Ctenocolpus*) *trilix* Cotton & Woods, 1935, Rec. S. Aust. Mus., 5 (3), p. 377, text fig. 4; Ludbrook, 1954, Trans. Roy. Soc. S. Aust., 77, p. 59.

Ctenocolpus trilix Cotton & Woods, Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.

Diagnosis—Small, whorls flattened, protoconch oblique. Sculpture of 3 distinct major spiral ribs with wide, smooth interspaces. One secondary sub sutural spiral

Dimensions—Height 6·5, diameter 2·5 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1675.

Material—3 specimens, Weymouth's Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs and Weymouth's Bores, Adelaide.

Subgenus COLPOSPIRA Donald, 1900

Colpospira Donald, 1900, Proc. Mal. Soc., 4 (2), p. 51.

Type species (o.d.) *Turritella runcinata* Watson.

Turritella (Colpospira) platyspiroides sp. nov.

pl. 2, figs. 1, 2.

Turritella sp. aff. *platyspira* T. Woods, Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 100.

Diagnosis—A rather small *Colpospira* with protoconch of one-and-a-half smooth globose turns. Adult whorls smooth, shining, flattish, rather constricted posteriorly, and in the earlier whorls slightly carinate in the anterior quarter. Later adult whorls with a second carina developed at the posterior one-quarter with a flat, smooth area between them. Periphery sharply angulate, base flattish.

Description of Holotype—Spire broken, adult whorls smooth, shining, nearly flat, at first carinate in the anterior and posterior one-quarter, with a flattened medial area between them. Periphery sharply angulate. Surface smooth except for fine axial growth lines revealing a deep, broad median apertural sinus and occasional spiral threads. There is a small cord on each carina and on the periphery. Base flattish, with 6 fine spiral lirae. Aperture subquadrate, outer lip with a broad median sinus.

Description of Paratype—Immature shell, showing the early whorls. Protoconch of one-and-a-half smooth globose turns, adult whorls at first flat with an anterior carina developing at the fourth adult whorl. Whorls gradually increasing, spire sharply tapering.

Dimensions—Total estimated height 18·5, diameter 5 mm.

Type Locality—Abattoirs Bore, Adelaide.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, F 15156.

Observations—The four examples of this species were previously referred to *platyspira* Tenison-Woods, from which the species differs in being larger and thicker, with a wider spire more gradually tapering than that of *platyspira*. The sculpture also differs.

Material—Holotype and 3 paratypes, Abattoirs Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs Bore, Adelaide.

Subgenus MAORICOLPUS Finlay, 1927

Maoricolpus Finlay, 1927, Trans. N.Z. Inst., 57, p. 389.

Type species (o.d.) *Turritella rosea* Quoy & Gaimard.

Turritella (Maoricolpus) murrayana subrudis Cotton & Woods

Turritella (*Maoricolpus*) *murrayana subrudis* Cotton & Woods, 1935, Rec. S. Aust. Mus., 5 (3), p. 371.

Maoricolpus subrudis Cotton & Woods, Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.

Turritella (*Peyrotia*) *murrayana subrudis* Cotton & Woods, Ludbrook, 1954, Trans. Roy. Soc. S. Aust., 77, p. 59.

Diagnosis—Fairly large, whorls 12 to 14, flat and medially depressed. Apical angle 15 deg. Anterior suture slightly carinate. Early spire whorls only slightly inflated and carinate at the anterior one-third. Sculpture strong and coarse, of about 12 primary spiral lirae with fine secondary lirae between; lirae stronger in the median depressed portion of the whorl.

Dimensions—Height 49, diameter 12 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1688.

Observations—Like *T.* (*Gazameda*) *acricula adelaidensis*, the present subspecies is a coarsely sculptured form of the typical species. In view of the range of variation in the sculpture of *murrayana*, one hesitates to separate the Dry

Creek Sands variant specifically, particularly as strengthening of the sculpture seems to be common to several species of this formation. The species *murrayana* may be long-ranging and widespread, but the amount of material available for comparison is small.

Material—Holotype and 19 paratypes, Abattoirs Bore.
Stratigraphical Range—Dry Creek Sands.
Geographical Distribution—Adelaide District.

Family MATHILDIDAE.

Genus VALSANTIA gen. nov.

Generic Characters—Shell very small, imperforate, solid. Protoconch small, paucigyrate, slightly inclined, immersed at the origin and smooth for one whorl followed by a brephic whorl with sharp, narrow axials. Adult whorls strongly and conspicuously cancellate. Aperture with outer lip expanded, channelled within corresponding to external spiral ribs, and conspicuously denticulate. Columella straight, with two median plaits. Inner lip slightly effuse at base.

Type species *Valsantia spectabilis* sp. nov.

Valsantia spectabilis sp. nov.

pl. 2, fig. 3.

Diagnosis—Protoconch small, smooth and immersed at tip, followed by one post-nuclear whorl with 10 sharp, narrow axials. Adult whorls four in a height of 4 mm. Sculpture of 3 strong spiral ribs, the median of which is on a carina, and one weaker subsutural rib, all crossed by axial costae narrower than the spirals but strong, elevated and laterally compressed. Interspaces deep, rhombic, intersections tuberculate. Base with 2 tuberculate spiral ribs. Columella with two median plaits.

Description of Holotype—Shell very small, solid, turreted, spire fairly low for the family, whorls relatively few. Apex small, paucigyrate, immersed at tip, slightly inclined, first whorl smooth, first post-nuclear whorl with 10 brephic axials. Adult whorls four, sculptured with 3 strong spiral ribs, the median of which is stronger and supported by a keel and one weaker subsutural rib all crossed obliquely and tuberculated by axial costae narrower than the spirals but elevated and compressed laterally. Interspaces deep and rhombic. Suture deep, canaliculate. Body whorl a little less than half the height of the shell, aperture about half height of the body whorl. Base convexly oblique with 2 spiral tuberculate ribs and a third inconspicuous tuberculate rib bordering the columella. Aperture sub-elliptical with outer lip well-rounded and expanded, canaliculate within corresponding to the external ribs which are produced externally beyond the axial margin, and inconspicuously denticulate with long, flat denticles. Columella straight, oblique, with two plaits well-spaced medially. Inner lip reflected over columella and slightly effuse anteriorly.

Dimensions—Height 4, diameter 2, height of body whorl 2·5 mm.
Type Locality—Hindmarsh Bore, 450-487 feet.
Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, F 15157.

Observations—This is a very elegant and interesting shell. Without the protoconch and columella features, it is reminiscent of *Mathilda* (*Opimilda*) *decorata* Hedley. However, the plaits on the columella are distinctive, and are possessed by no other genus, so far as can be determined, in the family. In apical characters, the genus comes closest to *Geganía* Jeffreys; the heterostrophic strongly tilted apex of *Mathilda* is not present, the apex being only slightly tilted and immersed at the origin. The apical characters and the sculpture suggest the subgenus *Tubena* Marwick created for *Geganía* (*Tubena*) *viola* Marwick from the New Zealand Awamoan. Both *Geganía* s. str. and *G.* (*Tubena*) are thin shells; *Valsantia* is solid for its size.

The species was inadvertently listed (Ludbrook, 1954, p. 59) as *Glyptozaria spectabilis* sp. nov.

Material—Holotype, Hindmarsh Bore; 3 paratypes, Weymouth's Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Hindmarsh and Weymouth's Bores, Adelaide.

Family ARCHITECTONIDAE.

Genus ARCHITECTONICA Röding, 1798.

Architectonica Röding ex Bolten, 1798, Mus. Bolt., **2**, p. 78.
(*Solarium* Lamarck, 1799, Mem. Soc. Hist. nat. Paris, 1, p. 71.)

Type species (s.d. Gray, 1847) *Trochus perspectiva* Linné.

Subgenus DISCOTECTONICA Marwick, 1931.

Discotectonica Marwick, 1931, N.Z. Geol. Surv. Pal. Bull., **13**, p. 101.

Type species (o.d.) *Architectonica balcombensis* Finlay.

Architectonica (Discotectonica) wannonensis (Tenison Woods)

pl. 2, figs. 4, 5.

Solarium wannonensis Tenison-Woods, 1879, Proc. Linn. Soc. N.S.W., 3 (3), p. 237, pl. 21, fig. 10.
Heliacus wannonensis Tenison-Woods sp. Harris, 1897, Cat. Tert. Moll. Brit. Mus., 1, p. 245; Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., **1** (2), p. 112; Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.
Architectonica wannonensis, T.-Woods, Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100.
Architectonica (Discotectonica) wannonensis (Tenison-Woods), Ludbrook, 1954, Trans. Roy. Soc. S. Aust., **77**, p. 59.

Diagnosis—A *Discotectonica* which is flatly convex above and convex below; whorls sculptured with granular spiral cords, increasing in number from 3 on the first adult whorl to 5 on the penultimate whorl, of which the infrasutural is stronger with fewer and larger granules, followed by three cords with smaller and more numerous granules equal in number to those of the previous three cords. An additional small cord shows at the suture, representing the incomplete embracing of the peripheral cord by the aperture. Peripheral cord strong and ovately-granular. Base convex with 6 cords with small granules followed by 3 cords of large and less numerous granules bordering the umbilicus. Aperture round within; inner lip angularly expanded at the junction with the peripheral cord and similarly expanded below at the position of the umbilical cord.

Dimensions of Hypotype—Height 2, diameter 6 mm.

Type Locality—Muddy Creek, Victoria.

Location of Holotype—Australian Museum, Sydney, F 1818.

Location of Hypotype—Tate Mus. Coll., F 15158.

Observations—The hypotype is twice the size of the holotype, and has been compared with authentic topotypes.

Material—Hypotype, Weymouth's Bore, 310-330 feet, 2 topotypes, Muddy Creek, Victoria (B.M. Coll.).

Stratigraphical Range—?Balcombian; Dry Creek Sands.

Geographical Distribution—Port Phillip Bay, Victoria, to Adelaide, South Australia.

Family VERMETIDAE.

Genus TENAGODUS Guettard, 1770.

Tenagodus Guettard, 1770, Mem. diff. Sci., 3, p. 128.
(*Siliquaria* Bruguière, 1789, Ency. Meth. (Vers.), **1**, p. 15.)
(*Tenagodes* P. Fischer, 1885, Man. de Conch., p. 692.)

Type species (monotypy) *Serpula anguinus* Linné

Subgenus TENAGODUS s. str.

(*Montfortia* Della Campana, 1890, Atti Soc. Ligust., 1, p. 139, *non* Recluz, 1843.)
(*Hemitenagodes* Rovereto, 1899, *id.*, **10**, p. 108, *nom. nov.* for *Montfortia*.)

Tenagodus australis (Quoy & Gaimard)

Siliquaria australis Quoy & Gaimard, 1834, in d'Urville, Voy. "Astrolabe" Zool., 3, p. 302; Cotton & Godfrey, 1931, S. Aust. Nat., 12 (4), p. 63, pl. 2, fig. 13; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 100; Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.

Tenagodes australis Q. & G., Tate, 1890, Trans. Roy. Soc. S. Aust., 13 (2), p. 177; Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., 1 (2), p. 144.

Tenagodus australis (Q. & G.), Ludbrook, 1954, Trans. Roy. Soc. S. Aust., 77, p. 59.

Diagnosis—Fairly large, vermiform, whorls about 5 at first spiral then irregularly coiled, angulated behind. Growth lines prominent, slit at first closed, followed by open, round holes, then a conspicuous, open and denticulated slit.

Dimensions—Length 105, greatest diameter of the tube at the base, 17 mm.

Type Locality—Westernport, Victoria; Recent.

Location of Holotype—Mus. d'Hist. nat. Paris.

Material—Portions of tubes, Hindmarsh, Weymouth's and Kooyonga Bores; numerous specimens, Abattoirs Bore.

Stratigraphical Range—Pliocene to Recent.

Geographical Distribution—Victoria, Tasmania and South Australia.

Family DIASTOMIDAE.

Genus Diastoma Deshayes, 1850.

Diastoma Deshayes, 1850, Traité elem. Conch. Atlas, p. 46.

Type species (monotypy) *Diastoma costellata* Deshayes = *Melania costellata* Lamarck.

Diastoma provisi Tate

pl. 1, fig. 4.

Diastoma provisi Tate, 1894, Journ. Roy. Soc. N.S.W. for 1893, 27, p. 177, pl. 10, fig. 8; Harris, 1897, Cat. Tert. Moll. Brit. Mus., 1, p. 232; Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., 1 (2), p. 138, 144; Ludbrook, 1954, Trans. Roy. Soc. S. Aust., 77, p. 59.

Neodiastoma provisi Tate, Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 100; Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.

Diagnosis—Adult whorls about 10, sculptured with about 18 axial costae per whorl, both costae and interspaces bearing fine axial growth striae, crossed by fine, frequent spiral threads, generally alternating in strength. The axial costae are interrupted at the posterior four-fifths of each whorl by a narrow impressed channel. Suture impressed, whorls overlapping. Whorls more or less varicate. Aperture loop-shaped, columella with a single plication; callosity reflected behind columella ridge.

Dimensions—Height 46, diameter 14, length of aperture 15, width of aperture 7 mm.

Type Locality—Dry Creek Bore, Adelaide.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1541.

Observations—*Diastoma provisi* is a restricted and typical fossil of the Dry Creek Sands and their equivalents. In the opinion of M. Chavan (personal communication) it is a true *Diastoma* and not related to *Neodiastoma*, type species *Mesalia melanioides* Reeve.

Material—Holotype and paratypes, Dry Creek Bore; numerous specimens Abattoirs Bore; 10 specimens Kooyonga Bore; 6 specimens Hindmarsh Bore; 3 specimens and fragments, Weymouth's Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Adelaide District, Hallett Cove, Eyre Peninsula.

Genus Ortortio Hedley, 1899.

Ortortio Hedley, 1899, Mem. Aust. Mus., 3 (3), p. 412.

Type species (monotypy) *Rissoa pyrrhacme* Melvill & Standen.

Obtortio liratus Ludbrook

Obtortio liratus Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 90, pl. 4, fig. 24; Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245; Ludbrook, 1954, Trans. Roy. Soc. S. Aust., 77, p. 59.

Diagnosis—Small, 7 adult whorls in a height of 5·2 mm., angulate at posterior one-third. Sculpture of 14 curved axial costae per whorl, crossed by prominent spiral lirae, absent or obsolete posterior to the angle. Base spirally lirate, aperture subovate with a short anterior canal.

Dimensions—Height 5·2, diameter 1·7 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1656.

Observations—*Obtortio* is an Indo-Pacific genus, here represented by the one species, occurring in small numbers in Abattoirs and Weymouth's Bores.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs and Weymouth's Bores, Adelaide.

Family POTAMIDIDAE.

Subfamily BATILLARIINAE.

Genus BATILLARIA Benson, 1842.

Batillaria Benson, 1842, Ann. Mag. Nat. Hist., 9, p. 488.
(*Lampania* Gray, 1847, Proc. Zool. Soc., 15, p. 153.)

Type species (monotypy) *Batillaria zonalis* = *Cerithium zonalis* Bruguière.

Subgenus ZEACUMANTUS Finlay, 1927.

Zeacumantus Finlay, 1927, Trans. N.Z. Inst., 57, p. 380.

Type species (o.d.) *Cerithium subcarinatum* Sowerby.

Batillaria (Zeacumantus) diemenensis (Quoy & Gaimard)

Cerithium diemenensis Quoy & Gaimard, 1834, Voy. Astrolabe, Zool., 3, p. 128, pl. 55, figs. 11-13.
Zeacumantus diemenensis Q. & G., Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 100; Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.
Batillaria (*Zeacumantus*) *diemenensis* (Q. & G.), Ludbrook, 1954, Trans. Roy. Soc. S. Aust., 77, p. 59.

Diagnosis—Total of 9 whorls in a height of 18 mm., axially plicate, with about 10 plications on the penultimate whorl and four spiral striae on each whorl. Aperture subovate, oblique, with a short recurved anterior canal.

Dimensions—Height 18 mm.

Type Locality—Tasmania, Recent.

Location of Holotype—Mus. d'Hist. nat. Paris.

Material—One worn specimen, Hindmarsh Bore.

Stratigraphical Range—Dry Creek Sands, and Recent.

Geographical Distribution—Southern Australia.

Batillaria (Zeacumantus) bivaricata (Ludbrook)

Clypeomorus bivaricatus Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 89; Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.
Batillaria (*Zeacumantus*) *bivaricata* Ludbrook, 1954, Trans. Roy. Soc. S. Aust., 77, p. 59.

Diagnosis—Protoconch of one-and-a-half whorls and nine adult whorls in a height of 11 mm. Whorls angulate at the posterior third, almost vertical in anterior two-thirds. Angulation more pronounced in early whorls, body whorl convex. Sculpture of curved axial costae, about 15 on the penultimate whorl, tuberculate at the angle, crossed by about six strong spiral lirae in the anterior two-thirds and four much weaker, more closely set lirae above the shoulder; the number of lirae increases by intercalation from two on the earliest whorls. Six fine spiral lirae on the base. Two varices on each whorl.

Dimensions—Height 11, diameter 3·1 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1629.

Observations—This species does not belong to *Clypeomorus* where it was originally described. Although its aperture has some features in common with that genus, the shape, texture and sculpture are very distinct. It is difficult to obtain a specimen with a mature or complete aperture; two, including the holotype, among the numerous specimens from Abattoirs Bore, have complete apertures. The affinities are with *B.* (*Z.*) *subcarinatum* Sowerby. Immature shells show similar features in both species.

Material—Numerous paratypes, Abattoirs Bore; 30 specimens Weymouth's Bore; 8 specimens Hindmarsh Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Adelaide District.

Batillaria (Zeacumantus) multilirata (Ludbrook)

Clypeomorus multiliratus Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 89, pl. 1, fig. 22; Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.
Batillaria (*Zeacumantus*) *multilirata* Ludbrook, 1954, Trans. Roy. Soc. S. Aust., 77, p. 59.

Diagnosis—Protoconch of three relatively large, convex whorls. Adult whorls sculptured with curved axial costae increasing from seven in the first whorl to eleven in the body whorl, crossed by numerous fine lirae, wider than interspaces, about fifteen in number on the penultimate whorl. Three varices per whorl.

Dimensions—Height 9·7, diameter 3·6 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1633.

Observations—Like the preceding species, *multilirata* should not have been placed in *Clypeomorus*. It is readily distinguishable from *bivaricata* by the absence of angulation in the early whorls and the 3 varices on each whorl. No complete specimens have as yet been found, and apertural features are still indeterminable.

Material—13 paratypes, Abattoirs Bore; 28 specimens, Hindmarsh Bore; 9 specimens, Weymouth's Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Adelaide District.

Subgenus BATILLARIELLA Thiele, 1929.

Batillariella Thiele, 1929, Handb. Syst. Weicht., 1, p. 208.

Type species (monotypy) *Bittium estuarinum* Tate.

Batillaria (Batillariella) estuarina (Tate)

Bittium estuarinum Tate, 1893, Trans. Roy. Soc. S. Aust., 17 (1), p. 190, pl. 5, fig. 12.
Batillaria (*Batillariella*) *estuarina* (Tate), Ludbrook, 1954, Trans. Roy. Soc. S. Aust., 77, p. 59.

Diagnosis—Twelve whorls in a height of 22 mm., early spire whorls medially angulate; sculpture of slightly arched axial plicae, about 12 on the penultimate whorl, and about six primary spiral lirae on the penultimate whorl, and fine secondary lirae rising between them. Interspaces and plicae fine, axially striate with crowded lines of growth. Aperture subcircular, somewhat effuse at the base and obliquely angulated.

Dimensions—Height 22, diameter 5 mm.

Type Locality—Port Adelaide Creek, between tidemarks; Recent.

Location of Holotype—S. Aust. Mus.

Observations—The only fossil example of *estuarina* is small and possibly juvenile. It is doubtfully conspecific with living topotypes from Port River, but is comparable with specimens from Western Australia which are smaller and more strongly sculptured.

Material—One specimen, Abattoirs Bore; 12 specimens, Western Australia; 15 specimens, Port River, Adelaide (B.M. Coll.).

Stratigraphical Range—Dry Creek Sands and Recent.

Geographical Distribution—South Australia to Western Australia, estuarine, between tidemarks.

Genus MANULONA Ludbrook, 1941.

Manulona Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 91.

Type species (o.d.) *Manulona arrugosa* Ludbrook.

Manulona arrugosa Ludbrook

Manulona arrugosa Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 91, pl. 4, fig. 26; Ludbrook, 1954, *id.*, 77, p. 59.

Diagnosis—Adult whorls 10 in a height of 8·7 mm.; conspicuously sculptured with a supra-sutural thread above which is a prominent band with about 12 elevated tubercles; above the band three flattened beaded lirae, the beads being about twice as numerous and very much smaller than the tubercles. Suture linear, irregular, anterior canal short and slightly reflexed.

Dimensions—Height 8·7, diameter 2·2 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1635.

Material—9 paratypes, Abattoirs Bore; 4 specimens, Weymouth's Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs and Weymouth's Bores, Adelaide.

Manulona lirasuturalis Ludbrook

Manulona lirasuturalis Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 91, pl. 4, fig. 27; Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 246; Ludbrook, 1954, Trans. Roy. Soc. S. Aust., 77, p. 59.

Diagnosis—Adult whorls 11 in a height of 9·1 mm. Whorls more or less smooth, faintly axially and spirally striate, with a row of about 9 tubercles above the suture giving a carinate appearance to the whorl anteriorly immediately above the suture; below the suture an inconspicuous row of fine, numerous beads. Suture slightly undulating with a single fine lira imbricating above.

Dimensions—Height 9·1, diameter 2·2 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1643.

Material—Seven paratypes, Abattoirs Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs Bore, Adelaide.

Subfamily ATAXOCERITHIINAE.

Genus ATAXOCERITHIUM Tate, 1894.

Ataxocerithium Tate, 1894, Journ. Roy. Soc. N.S.W., 27, p. 179.

Type species (o.d.) *Cerithium serotinum* A. Adams.

Ataxocerithium bidenticulatum sp. nov.

pl. 2, figs. 6, 7

cf. *Ataxocerithium* sp. Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100.

Diagnosis—An *Ataxocerithium* with about 26 axial costae on the penultimate whorl crossed by strong spiral cords increasing from three on the first adult whorl to from five to eight on the body whorl. Five on the penultimate whorl. Inner lip with 2 denticles on the columella and one posterior denticle continuing within the aperture as a fairly thick rib bordering a slight posterior canal.

Description of Holotype—Shell of moderate size, apex broken, seven adult whorls remaining; whorls slightly convex, suture deep, canaliculate. Whorls sculptured with narrow axial costae, about 26 on the penultimate whorl, which are crossed and slightly tuberculated by strong spiral cords with straight sides. The cords are not regularly spaced, and on the penultimate whorl the two posterior cords are equal, with interspaces of equivalent width, while the next

two cords are nearly contiguous; the anterior cord is spaced as the two posterior cords. The interspaces are subrectangular and not very deep or sharply outlined. Base convexly oblique with five spiral cords, the lowest of which only partly embraces the anterior canal; there are in addition faint axial growth striae. Aperture quadrately ovate, outer lip broken in the holotype, inner lip thin and recurved over columella with two small denticles on the anterior half and one denticle at the posterior, which continues within the aperture as a fairly thick rib bordering a canal, visible within but not cutting through the outer lip. Anterior canal of moderate length, tubular.

Dimensions—Height 11, diameter 4 mm.

Paratype a—Specimen consisting of last two whorls with aperture complete.

Paratype b—Juvenile with protoconch undamaged. Protoconch sharp and prominent, of one-and-a-half smooth, high convex turns followed by a half turn with brephic axials.

Type Locality—Weymouth's Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, F 15159.

Observations—Finlay (1927, p. 383) has noted that both Australian and New Zealand examples of *Ataxocerithium* occasionally possess a rudimentary plait. The slight denticles which are a distinguishing feature of this species would appear to be a specific character.

Material—Holotype and paratype *a*, Weymouth's Bore; paratype *b* and 24 incomplete paratypes, Abattoirs Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Hindmarsh and Abattoirs Bores.

Ataxocerithium sp.

Ataxocerithium concatenatum Tate, Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 100.

Observations—One incomplete specimen from Abattoirs Bore is distinct from *bidenticulatum*. Sculptured with about 30 axial costae per whorl crossed and tuberculated by regular spiral cords of which there are 7 on the penultimate and 9 on the body whorl. The sculpture is finer and more even than in *bidenticulatum* and differs from *concatenatum* with which the shell was previously identified in that the spiral and not the axial sculpture is dominant. Shape of the shell is also distinctive. Whorls are convex and the suture is impressed but not canaliculate as in *bidenticulatum*.

Genus Adelacerithium Ludbrook, 1941.

Adelacerithium Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 90.

Type species (monotypy) *Adelacerithium merultum* Ludbrook.

Adelacerithium merultum Ludbrook

Adelacerithium merultum Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 90, pl. 4, fig. 23; Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245; Ludbrook, 1954, Trans. Roy. Soc. S. Aust., 77, p. 59.

Diagnosis—14 adult whorls in a height of 9·5 mm. Whorls flattened, sculptured with fine, prominent curved axial costae, 24 on the penultimate whorl, crossed by approximately equidistant spiral lirae, 5 on the penultimate whorl; intersections slightly granulose. Number of costae per whorl rapidly increasing at about the seventh whorl and decreasing in strength towards the aperture. Spiral sculpture variable in later whorls.

Dimensions—Height 9·5, diameter 2·2 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1630.

Observations—The genus *Adelacerithium* is closely related to *Taxonia* Finlay which is restricted to the Nukumaruan in New Zealand. The sculpture in

Adelacerithium is finer, there being 4 to 5 spirals instead of typically three in *Taxonia*. The base of *Taxonia* appears to be less convex than that of *Adelacerithium*, so far as one can tell in the absence of the type species of *Taxonia*.

Material—Holotype and 14 paratypes, Abattoirs Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs Bore, Adelaide.

Family CERITHIIDAE.

Subfamily LITIOPINAE.

Genus DIALA A. Adams, 1861.

Diala A. Adams, 1861, Ann. Mag. Nat. Hist., ser. 3, **8**, p. 242.

Type species (s.d. Fischer, 1885) *Diala varia* A. Adams.

Subgenus MERELDIA Ludbrook, 1941.

Mereldia Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 92.

Type species (monotypy) *Mereldia incommoda* Ludbrook.

Diala (Mereldia) incommoda (Ludbrook)

Mereldia incommoda Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 92.

Diagnosis—A *Mereldia* differing from *Diala* in having a dome-shaped protoconch and persistently striated whorls. Protoconch of two flattened whorls and nine adult whorls in a height of 10 mm. Whorls sculptured with about 16 fine, spiral striae per whorl, unequally spaced.

Dimensions—Height 10, diameter 3·6 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1638.

Observations—Introduced with full generic rank, *Mereldia* now appears on examination of a wide range of *Diala* to warrant no more than subgeneric distinction from *Diala* s. str. The shell is a good deal larger than typical *Diala*, and the striations are persistent over the whole shell.

Material—Holotype and 4 paratypes, Abattoirs Bore; 1 specimen, Hindmarsh Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs and Hindmarsh Bores.

Subfamily CERITHIINAE.

Genus BITTIUM Leach, 1847.

Bittium Leach in Gray, 1847, Ann. Mag. Nat. Hist., **20**, p. 270.
(*Cerithiolum* Tiberi, 1869, Bull. Malac. Ital., **2**, p. 263.)

Type species (s.d. Gray, 1847) *Murex reticulatum* Montfort = *Stromboformis reticulatus* Da Costa.

Subgenus SEMIBITTIUM Cossmann, 1896.

Semibittium Cossmann, 1896, Ann. Soc. Malac. Belg., **31**, Mem., p. 29.
(*Cacozelia* Iredale, 1924, Proc. Linn. Soc. N.S.W., **49**, pp. 183, 246, *non.* Grote, 1878.)
(*Cacozeliana* Strand, 1928, Arch. Naturgesch, **92**, A.8, p. 66.)

Type species (s.d. Cossmann, 1906) *Cerithium cancellatum* Lamarck.

Bittium (Semibittium) subgranarium sp. nov.
pl. 2, fig. 8.

Cacozeliana cf. *granaria* Kiener, Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100.
Cacozeliana granaria Kiener, Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.

Diagnosis—Protoconch of three narrowly convex, smooth turns and 8 adult whorls in a height of 4 mm. Diameter one-quarter height. Whorls decreasing in convexity anteriorly. Sculpture on the whorls of five flat spiral cords separated by narrow linear interspaces and about 14 narrow axial costae per whorl. Axial costae cross and tuberculate the posterior three of the spiral cords and fade out on the anterior portion of each whorl so that the anterior two cords are not tuberculate. Four plain spiral cords on the base.

Description of Holotype—Shell very small, acutely conical. Protoconch somewhat damaged in the holotype, of three narrowly convex turns. Adult whorls 8, feebly convex and decreasing in convexity anteriorly from the early spire whorls to the body whorl. Suture deep. Body whorl about one-third height of shell, subangular at the periphery. Aperture obliquely and narrowly ovate with a short anterior canal, slightly curved to the left. Posterior canal absent. Outer lip somewhat concavely curved, not varicose, but there is a varix behind the lip, about one-quarter way round the body whorl. Ornament on the whorls of five flat spiral cords separated by narrow linear interspaces, and about 14 narrow axial costae per whorl. The axial costae cross and tuberculate the posterior three of the spiral cords and fade out on the anterior portion of each whorl so that the anterior two cords are not tuberculate. Base oblique and slightly convex, with four plain spiral cords.

Dimensions—Height 4, diameter 1, height of body whorl 1·3 mm.

Type Locality—Hindmarsh Bore, 450-487 feet.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, F 15160.

Observations—This species is closely related to the Recent *B.* (*S.*) *granarium* Kiener, with which it has previously been compared. It is much smaller than *granarium* which has all the spiral cords on the whorls tuberculate; in *subgranarium* the axial ribs fade out on the anterior portion of the shell where the cords are simple. The posterior three cords only are tuberculated by the axials.

Material—Holotype and three paratypes, Hindmarsh Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs and Hindmarsh Bores.

Genus Thericium Monterosato, 1890.

Thericium Monterosato, 1890, Nat. Sicil., **9**, p. 163.
(*Vulgocerithium* Cossmann, 1895, in Sacco, Moll. Terr. terz., **17**, p. 7.)
(*Pithocerithium* Sacco, 1895, *ibid.*, p. 28.)
(*Pliocerithium* Monterosato, 1911, Giorn. Sci. Nat. Econ. Palermo, **28**, p. 67.)
(*Gladiocerithium* Monterosato, 1911, *ibid.*, p. 68.)
(*Drillocerithium* Monterosato, 1911, *ibid.*, p. 71.)
(*Hirtocerithium* Monterosato, 1911, *ibid.*, p. 73.)
(*Lithocerithium* Monterosato, 1911, *ibid.*, p. 75.)

Type species (o.d.) *Murex alacastrum* Brocchi = *Cerithium vulgatum* Bruguière.

Subgenus Thericium s. str.

Thericium (Thericium) fallax (Ludbrook)

pl. 1, fig. 5.

Terebralia fallax Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 91, pl. 4, fig. 21; Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.

Diagnosis—Protoconch of two small globose whorls followed by six convex whorls, very finely and conspicuously cancellate, posterior half more finely cancellate than anterior half of each whorl. Whorls plicate from about sixth whorl, plications about seven per whorl and increasing in prominence anteriorly. Spiral sculpture becomes dominant from seventh whorl and cancellation disappears. In later whorls plications and interspaces crossed by fine spiral threads which are at first rounded and in the later whorls become flattened, each supporting a median striation.

Dimensions—Height 31, diameter 11·5 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1621.

Observations—One specimen (pl. 1, fig. 5) complete except for the apex, was recovered from a bore put down on Peoze's property, Section 4251, Hundred of Munno Para, in 1955.

Material—Portions of about 70 paratypes, mainly juveniles, Abattoirs Bore; 6 specimens, Weymouth's Bore; hypotype, Sec. 4251, Hd. Munno Para, at 238 to 256 feet.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Adelaide District.

Subgenus CHAVANICERITHIUM subgen. nov.

Subgeneric Characters—Shell with true varices, generally one strong varix on the body whorl opposite the aperture. Aperture oblique, ovate, with a short, pointed posterior canal and a parietal tubercle below it. Anterior canal oblique and slightly recurved. Columella concave, without plaits, as in *Thericium*. Shell differs from that genus in having the axial sculpture suppressed in the early whorls and developing into convex, rounded axial ribs or folds in the later whorls. Whorls with a subsutural band which commonly interrupts the axial ribs. Outer lip characteristically inflexed. Columella generally with one or two spiral furrows extending on the base below the periphery and visible particularly in younger shells.

Type species *Terebralia adelaidensis* Howchin & Cotton.

Thericium (Chavanicerithium) adelaidense (Howchin & Cotton)

pl. 1, fig. 3.

Terebralia adelaidensis Howchin & Cotton, 1936, Trans. Roy. Soc. S. Aust., 60, p. 131, pl. 1, figs. 1, 2; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 100.

Campanile adelaidensis Howchin & Cotton, Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.

Diagnosis—Early whorls flat to concave, later whorls convex. Sculpture comparatively fine and inconspicuous in the early whorls with a subsutural band supporting 2 or 3 spiral striae; anterior three-quarters of whorl, which is medially constricted, sculptured with about 8 somewhat irregular spiral cords, some of which are surmounted and divided by spiral striae; interspaces linear, much narrower than cords, and deeper anteriorly so that the cords appear to be imbricating. Whole whorl crossed by concave growth striae and numerous axial costae; costae decrease in number and increase in strength to about 12 on the penultimate whorl. Strong costae in anterior whorls of adult shell are interrupted or effaced posteriorly by a constriction in the posterior third of the whorl.

Dimensions—Height 85, diameter 27 mm.

Type Locality—Glanville Bore, 375-400 feet.

Location of Holotype—S. Aust. Mus., Reg. No. D 12852.

Description of Hypotype (Hindmarsh Bore, pl. 1, fig. 3)—Shell large, solid, elongate, conical, early whorls flat to concave, later whorls convex. Suture imbricating, undulating in later whorls, straight in early whorls. Sculpture comparatively fine and conspicuous in the early whorls, with a subsutural band, somewhat more than one-quarter width of the whorl, supporting two or three spiral striae, the rest of the whorl, which is medially constricted, sculptured with about eight rather irregular spiral cords, some of which are surmounted and divided by the spiral striae; interspaces linear, much narrower than cords and deeper anteriorly so that the cords appear to be imbricating. Band and cords all crossed concavely by growth striae and by numerous gradually developing axial costae, which tend to tuberculate the spirals. Axial costae decrease in number and increase in intensity to about twelve on the penultimate whorl. In the anterior whorls of the adult shell the strong costae are interrupted or effaced posteriorly by a constriction in the posterior third of the whorl.

Aperture oblique, ovate, with a short, pointed posterior canal and a posterior tubercle below it on the inner lip. Inner lip reflexed over the arcuate columella. Anterior canal short and strongly reflexed with a twist at the anterior end of the columella. Outer lip expanded and slightly produced anteriorly, concave posteriorly, and convex anteriorly in profile. Lip not varicate, but

there is a strong varix on the body whorl between one-half and two-thirds the distance from the outer lip.

Observations—This is one of the most typical and restricted gastropods of the Dry Creek Sands. Its superficial resemblance in shape and sculpture to *Terebralia palustris* Linné, an estuarine Indo-Pacific species, led the original authors to locate it in *Terebralia*. The resemblance, however, is entirely superficial and appears to be a case of homeomorphy; the columella as revealed in eroded specimens lacks the diagnostic plaits of *Terebralia*, while the strong varix on the body whorl identifies the shell with the Cerithiidae. In almost all respects the shell is a typical *Thericium*. However, the sculpture lacks the angulate axial costae of *Thericium* s. str., the early whorls are flatter and the subsutural band is characteristic. The anterior canal is short in the adult but appears longer in the juvenile, is oblique and slightly recurved; the tooth-like tubercle is recognizable only when the aperture is completely preserved, but there are generally one or more strong cords below the periphery on the base, not necessarily related to the tubercle. These are very conspicuous in the tropical *C.* (*T.*) *opportunum* and in the Adelaide species.

The subgenus is therefore created, named for Monsieur Andre Chavan of Soyssel, France, who has studied the classification of the Cerithiidae. Into the subgenus fall, in addition to the type species, *Cerithium torri* Tate, *C. pritchardi* Harris, as well as the Indo-Pacific *opportunum* Bayle and the common Italian species *varicosum* Brocchi. The Parisian Eocene *semicostatum* and *filiferum*, both of Deshayes, may possibly belong to the same lineage.

Material—Hypotype and 4 broken specimens, Hindmarsh Bore; 2 specimens, Weymouth's Bore; 1 broken specimen, Kooyonga Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Adelaide District.

Thericium (Chavanicerithium) torri (Tate)

pl. 1, figs. 1, 2.

Cerithium torri Tate, 1899, Trans. Roy. Soc. S. Aust., 23 (1), p. 109, pl. 1, fig. 2.

Diagnosis—A fairly large *Chavanicerithium* sculptured with conspicuous, distant, raised, moderately oblique, more or less nodulose axial costae, conspicuously interrupted in the posterior of each whorl and continuous in the anterior part of the whorl only, at least on the penultimate whorl. In young shells entire whorl covered with close, irregular spiral striations generally stronger on the costae, and fainter axial growth lines concave to the aperture.

Dimensions—Total estimated length 160 mm., diameter 24 mm.

Type Locality—"Murray Desert"? – Tareena, N.S.W.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 832. Hypotypes, F 15175, F 15176, Tate Mus. Coll.

Observations—Juveniles of this species are difficult to separate from juveniles of *T.* (*C.*) *pritchardi* (Harris), and closely resemble the Recent *T.* (*C.*) *opportunum* (Bayle) = *Cerithium polygonum* Sowerby from Northern Australia. The interruption of the axial costae and their nodulose character in the adult serve to distinguish the species. The holotype is a larger shell than the Dry Creek Sands relatives which attain an estimated total length of between 80 and 90 mm.

Material—Holotype; hypotype and 11 other specimens, Abattoirs Bore; 7 specimens, Bore, Sec. 4251, Hd. Munno Para; 1 specimen, Jones's Bore; 5 specimens, Weymouth's Bore.

Stratigraphical Range—Dry Creek Sands and unnamed formation, Murray Basin.

Geographical Distribution—Adelaide District; ? Tareena, N.S.W.

Genus SEMIVERTAGUS Cossmann, 1889.

Semivertagus Cossmann, 1889, Ann. Soc. Roy. Mal. Belg., 24, p. 28.

Type species (o.d.) *Cerithium unisulcatum* Lamarck.

Semivertagus capillatus Tate

pl. 2, fig. 9.

Semivertagus capillatus Tate, 1894, Journ. Roy. Soc. N.S.W., 27, p. 178, pl. iii, fig. 1; Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., 1 (2), p. 144; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 100; Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.

Diagnosis—Twelve whorls in a length of 17 mm. Suture conspicuous, imbricating. Sculpture of about 20 spiral striae per whorl, narrower than interspaces which increase in width towards the anterior suture, crossed by weaker arched growth striae. Columella without plication, anterior canal short, inner lip callous and reflected over columella, with a posterior tubercle.

Dimensions—Height 17, diameter 5 mm.

Type Locality—Dry Creek Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1539c.

Material—Hypotype and 2 specimens, Hindmarsh Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Adelaide District.

Genus HYPOTROCHUS Cotton, 1932.

Hypotrochus Cotton, 1932, Rec. S. Aust. Mus., 4 (4), p. 540.

Type species (o.d.) *Cerithium monachus* Crosse & Fischer.

Hypotrochus semiplicatus sp. nov.

pl. 2, fig. 10.

cf. *Hypotrochus penetricinctus* Cotton, Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 100.

Hypotrochus penetricinctus Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.

Diagnosis—Whorls slightly convex, angulate above the suture; eight adult whorls in a height of 6 mm., sculptured with axial plicae, 9 per whorl, obsolete on the posterior part of the whorl, broadening and increasing in strength towards the anterior suture immediately above which they meet a suprasutural cord which is undulated on its anterior side by the anterior limit of the plicae. Plicae become obsolete on the body whorl. Spiral sculpture of four deep and clear cut striae and the flattish suprasutural cord which is bordered above by the anterior striae and undulated below by the axial plicae on all the whorls but the body whorl where it is represented by a wider band between the striae.

Description of Holotype—Shell small, elongate-conical, surface smooth and rather polished. Whorls slightly convex and angulate above the suture; suture linear, with a tendency to undulate. Apex small and elevated, of two smooth turns, adult whorls eight, of which the first is sculptured with one strong brephic spiral, the next six whorls with nine axial plicae per whorl, obsolete in the posterior part of the whorl, broadening and increasing in strength towards the anterior suture above which they meet a suprasutural cord which is undulated on its anterior side by the lower edge of the plicae. Plicae become obsolete on the body whorl and die out over the whole of the whorl. Spiral sculpture of four fairly deep and clear-cut striae and the suprasutural cord bordered above by the axial plicae on all the whorls but the body whorl, where it is represented by a wider band between the striae. Four evenly-placed striae from the periphery, which is subangular, over the base to the columella. Aperture subovate and oblique, columella gently arched, anterior canal short and turned to the left. Outer lip with a varix behind it.

Dimensions—Height 6, diameter 2, height of body-whorl 2·7, height of aperture 1·5 mm.

Type Locality—Weymouth's Bore, 310-330 feet.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, F 15161.

Observations—This small *Hypotrochus* is distinguishable from the Recent *penetricinctus* by the absence of keels. There is a suggestion of carination at the cord above the suture, but it can scarcely be described as a keel, and is not present on the body whorl.

Material—Holotype and 12 paratypes, Weymouth's Bore, 18 paratypes, Abattoirs Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Weymouth's and Abattoirs Bores, Adelaide.

Family CERITHIOPSIDAE.

Genus CERITHIELLA Verrill, 1882.

Cerithiella Verrill, 1882, Trans. Connect. Acad., 5, p. 522.

Type species (o.d.) *Cerithium metula* Lovén.

Subgenus COXELLARIA subgen. nov.

Subgeneric Characters—Shell very small and very elongate, subulate, shining and solid. Whorls flat. Protoconch large and elevated, multispiral, tip heterostrophic, first 2 whorls only partially in contact. Smooth apical whorls followed by one-and-a-half brephic turns with close concavely-curving axials. Adult whorls ornamented with flattish thick spiral ribs which cross and tuberculate the fairly numerous axial ribs. Axial ribs nearly straight, not curved as in *Cerithiella* s. str. Aperture subquadrate, outer lip nearly perpendicular in profile instead of concave as in *Cerithiella* s. str. Anterior canal strongly twisted. Base flat.

Type species *Cerithiella trigemmata* Chapman & Crespin. The subgenus is named in honour of Dr. L. R. Cox of the British Museum (Natural History).

Cerithiella (Coxellaria) trigemmata Chapman & Crespin

pl. 2, fig. 11.

Cerithiella trigemmata Chapman & Crespin, 1928, Rec. Geol. Surv. Vic., **5** (1), p. 116, pl. 8, fig. 48; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100; Crespin, 1943, Aust. Min. Res. Surv. Bull. 9, p. 96 (mimeographed).

Certhiella (lapsus calami for *Cerithiella*) *trigemmata* Chapman & Crespin, Cotton, 1952, Geol. Surv. S. Aust. Bull. 27, appendix 4, p. 245.

Diagnosis—16 whorls in a height of 8 mm. Protoconch large and elevated, tip pointed and heterostrophic, apical 3 whorls followed by one-and-a-half turns with brephic axials. Adult whorls flat, ornamented with ten straight axial costae per whorl, crossed and tuberculated by three flattish spiral ribs about equal to the interspaces. Interspaces rectangular, smooth. Suture linear, excavate. Aperture subquadrate, outer lip straight and perpendicular in profile.

Dimensions—Height 5·75, diameter 1 mm.

Type Locality—Mitchell River, Victoria; Miocene.

Location of Holotype—Dennant Coll., Nat. Mus., Melbourne.

Observations—For this long-ranging and widespread species and the two succeeding species, the new subgenus *Coxellaria* is created. Compared with the type species, *Cerithiella metula* Lovén from the North Sea, species of *C.* (*Coxellaria*) are different in texture; the whorls are shining and solid and the growth lines are not visible. The whorls are typically flat, the shell is very elongate-subulate. The sculpture is coarser and flatter and not so sharply cancellate as in *Cerithiella* s. str. The axial sculpture of *Cerithiella* is markedly curved; it is straight or nearly so in *Coxellaria*. The protoconch is large, resembling some members of *Triphora*. The subgenus is related to or includes two species from the Paris Basin Eocene, *Cerithiella clava* Lamarck and *C. multispirata* Deshayes. In addition to the type species, the subgenus is represented by one closely re-

lated species, and one in which the spiral sculpture is absent, from Brown Coal Shaft, Altona, Victoria, in the British Museum Collection.

Material—5 specimens, Abattoirs Bore; 2 specimens, Brown Coal Shaft, Altona, Victoria, B.M. Coll.

Stratigraphical Range—"Tertiary".

Geographical Distribution—Gippsland, Vic., to Adelaide, S.A.

Cerithiella (Coxellaria) perelongata (Ludbrook)

Cerithiopsis perelongatus Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 90, pl. 4, fig. 25 (in part).

Diagnosis—Protoconch elevated, three carinate, large, smooth, tapering whorls; tip heterostrophic. Adult whorls 8 in a height of 6 mm., flattened, sculptured with three equal spiral costae crossed by about 16 axial costae per whorl less conspicuous than the spirals which are flatly gemmulate at the intersections. At first the whorls are carinate at the anterior but rapidly flatten. The median spiral tends to be more gemmulate than the anterior and posterior which are flattened.

Dimensions—Height 6·1, diameter 1·1 mm.

Type Locality—Abattoirs Bore, Adelaide.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1651.

Observations—One perfect specimen was obtained from Weymouth's Bore. The elevated protoconch with a large second whorl, strongly carinate, and a smaller third whorl is followed by adult whorls at first carinate near the suture at the position of the anterior of the three spiral ribs.

The suture and interspaces are linear, in the later whorls the suture being distinguishable from the interspaces between the spirals only by being more excavate.

Material—Holotype and 2 paratypes, Abattoirs Bore; 2 specimens, one perfect, Weymouth's Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs and Weymouth's Bores, Adelaide.

Cerithiella (Coxellaria) superspiralis sp. nov.

pl. 2, fig. 12.

Cerithiopsis perelongatus Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 90 (in part).

Diagnosis—Shell large for the subgenus and extremely elongate. Sculpture on the flat whorls of about 18 relatively inconspicuous axial ribs crossed by three strong spirals of which the anterior and median are narrower and more roundly gemmulate at the junctions with axials, the posterior broader and flatter and only obsoletely gemmulate.

Description of Holotype—Shell incomplete, early whorls missing, nine adult whorls remaining; large for the subgenus, solid, very elongate-subulate. Whorls flat, suture linear, and inconspicuous unless viewed from the apex towards the aperture, when it is seen to be imbricated by the posterior spiral rib. Whorls sculptured with numerous axial ribs, eighteen on the penultimate whorl, crossed by three strong spirals with two equal interspaces between them. The anterior and median spirals are narrower than the posterior and are more distinctly and roundly gemmulate. The posterior rib borders the suture, is flat and only obsoletely gemmulate. All the ribs are steeply terminated on the posterior side and gently slope anteriorly. The contrast is shown by viewing from apex to aperture. Aperture broken, outer lip indeterminable, columella concave; remains of anterior canal shown by twist at the end of the columella. Base flat, smooth except for concave axial growth striae crowding in towards the columella. Periphery angulate with two smooth cords.

Dimensions—Length of 9 whorls 8·5, diameter 2·5; total estimated length 12 mm. or greater.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, F 15162.

Observations—In the original description of *Cerithiopsis perelongatus* (Ludbrook, 1941, p. 90) a paratype was cited as a much larger shell with sculpture consistent with that of the holotype. The two specimens of *perelongatus* from Weymouth's Bore have now enabled the species to be more accurately diagnosed, and it is realised that the large specimen is not conspecific with *perelongatus*. The sculpture is not, as stated previously, consistent with that of *perelongatus*.

Material—Holotype only.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs Bore, Adelaide.

Genus SEILA A. Adams, 1861.

Seila A. Adams, 1861, Ann. Mag. Nat. Hist., ser. 3, 7, p. 131.

Type species (s.d. Dall, 1889) *Triphoris dextroversa* Adams & Reeve.

Subgenus NOTOSEILA Finlay, 1927.

Notoseila Finlay, 1927, Trans. N.Z. Inst., 57, p. 382.

Type species (o.d.) *Cerithium terebelloides* Hutton.

Seila (Notoseila) triplanicincta sp. nov.

pl. 2, figs. 13, 14.

Seila (Notoseila) crocea Angas, Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 100.

Diagnosis—Shell very elongate-subulate, with a total of 15 whorls in a height of 12 mm. Sculptured with three flat equal spiral ribs on each whorl, approximately equal to the interspaces. Ribs smooth, with flat upper surface and sides at right angles to the upper surface. Interspaces flat, marked by axial growth lines. Suture linear or marked by a fine thread.

Description of Holotype—Shell of moderate size for the genus, very elongate-subulate. Protoconch large and elevated, tip broken but 2 whorls remaining, smooth and convex. Adult whorls flat, gradually increasing, sculptured with three flat spirals on each whorl of equal size and approximately equal to the interspaces. Upper surface of ribs smooth and flat, sides at right angles to the upper surface. Interspaces crossed by fine axial striae of growth. Suture imperceptible but indicated by a fine spiral lira. Aperture broken in the holotype. Columella concave, with a very strongly recurved short anterior canal.

Dimensions—Height 12, diameter 2 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, F 15163.

Paratype—A portion of a specimen consisting of the body and penultimate whorls shows the aperture as subquadrate with the outer lip perpendicular when viewed in profile. The base is flat and smooth, except for 2 lirae, finer than the spiral ribs, on the angulate periphery.

Observations—S. (*N.*) *triplanicincta* is not conspecific with S. (*N.*) *crocea*. The ribs are quite flat, the whorls are not at all convex except for the protoconch, and the shell is more attenuated.

Material—Holotype, Abattoirs Bore; 2 paratypes, Hindmarsh Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs and Hindmarsh Bores, Adelaide.

Family TRIPHORIDAE.

Genus TRIPHORA Blainville, 1828.

Triphora Blainville, 1828, Dict. Sci. Nat., 55, p. 344.

Type species (o.d.) *Triphora gemmata* Blainville.

Subgenus ISOTRIPHORA Cotton & Godfrey, 1931.

Isotriphora Cotton & Godfrey, 1931, S. Aust. Nat., 12 (4), p. 52.

Type species (o.d.) *Triphora tasmanica* = *Triforis tasmanica* Tenison-Woods.

Triphora (Isotriphora) salisburyensis sp. nov.

pl. 2, fig. 15.

Triphora sp. Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 92.

Diagnosis—Protoconch of 3 gemmulate whorls, blunt at tip. Adult whorls 11, making a total of 14 whorls in a height of 7 mm. First two adult whorls with two rows of granules; on the third whorl a thread rises between them and gradually develops into a third row of granules. The granules are produced at the intersection of the axials by three equal spirals, which are steeply terminated on their sides, and the interspaces tend to be rhombic. Suture canaliculate. Base with two keels, one on the periphery and one less than halfway between it and the base of the columella.

Description of Holotype—Protoconch broken. Adult whorls ten, of which the first two have two rows of granules. On the third a thread rises between them and gradually develops into a third row of granules. These granules are produced at the points of intersection of the radial costae, about 20 per whorl, and the three equal spirals which override the axials. Spirals steeply cut off on their sides, interspaces tending to be rhombic. Suture linear, deeply set in a channel between two rows of granules. Base smooth except for axial growth lines with two keels, one on the periphery and one less than halfway between the periphery and the base of the columella. Outer lip, when viewed in profile, is at first convex then nearly straight, effuse at the base and upcurved to meet the base of the columella. Anterior canal strongly retroflexed and almost cylindrical.

Dimensions—Height 7, diameter 1·5 mm.

Type Locality—Weymouth's Bore, Adelaide.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, F 15164.

Observations—Compared with the type species of the subgenus, *T. (I.) tasmanica*, the present species is smaller and more attenuated. There are 14 whorls in a height of 7 mm. as contrasted with 18 whorls in a height of 9 mm. in *tasmanica*. The sharp termination of the edges of the spirals is distinctive, together with the disposition of the keels on the base.

Material—Holotype and paratype, Weymouth's Bore; one fragment, Abattoirs Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs and Weymouth's Bores, Adelaide.

Subgenus NOTOSINISTER Finlay, 1927.

Notosinister Finlay, 1927, Trans. N.Z. Inst., 57, p. 384.

Type species (o.d.) *Triphora fascelina* Suter.

Triphora (Notosinister) praegranifera sp. nov.

pl. 2, fig. 16.

Triphora sp. Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 92.

Diagnosis—A *Notosinister* with protoconch of two smooth turns followed by three turns carinate in the anterior one-third; adult whorls nine making total of 14 whorls in a height of 4.4 mm. First four whorls sculptured with 2 rows of about 16 granules per whorl, a third row developing between them at the fifth whorl. Suture linear, inconspicuous. Base smooth, with three spiral cords.

Description of Holotype—Shell elongate-turreted, solid, somewhat pupiform. Protoconch large, elevated, polygyrate, of two smooth turns followed by three turns carinate in the anterior one-third and carrying about 20 brephic axials per whorl. Adult whorls 9, of which the first four are sculptured with

two rows of about 16 granules per whorl, a third row rising between them at the fifth whorl and increasing gradually in strength until on the last whorl there are three approximately equal rows, the posterior being somewhat stronger than the other two. Suture inconspicuous, linear. Base smooth with three spiral cords. Outer lip broken in the holotype.

Dimensions—Height 4·4, diameter 1·5 mm.

Type Locality—Weymouth's Bore, 310-330 feet.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, F 15165.

Observations—*T. (N.) granifera* Brazier appears to be the nearest relative to the present species.

Material—Holotype and one paratype, Weymouth's Bore; 13 paratypes, mostly broken, Abattoirs Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Weymouth's and Abattoirs Bores, Adelaide.

Superfamily SCALACEA.

Family SCALIDAE.

Genus AMAEA H. & A. Adams, 1853.

Amaea H. & A. Adams, 1853, Gen. Rec. Moll., 1, p. 223.

Type species (s.d. Fischer, 1885) *Scalaria magnifica* Sowerby.

Subgenus AMAEA s. str.

Amaea (Amaea) triplicata (Tate)

pl. 3, fig. 1.

Scalaria (Eglisia) triplicata Tate, 1890, Trans. Roy. Soc. S. Aust., 13 (2), p. 231.
Scalaria triplicata Tate, 1892, *id.*, Supp. pl. 9, fig. 2.
Eglisia triplicata Tate, Harris, 1897, Cat. Tert. Moll. Brit. Mus., 1, p. 270; Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., 1 (2), p. 138; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 100.

Diagnosis—An *Amaea* with 15 whorls in a height of 28 mm. Sculptured with about 25 thin, more or less elevated costae per whorl, which are curved forward and decurrent at the posterior suture; axials either crossed by or crossing three prominent elevated rounded spiral cords which are a little to the anterior of the whorl. Body whorl with four strong spiral cords, one on the periphery. Base with about 10 spiral lirae crossed by fine radials corresponding to the axial costae on the whorls.

Dimensions—Height 28, diameter 7, height and width of aperture 5 mm.

Type Locality—Muddy Creek, Victoria; Pliocene.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 790D.

Observations—The species *triplicata* belongs to *Amaea* s. str. which is restricted to the Indo-Pacific in Recent times, the nearest species to the fossil being *A. kieneri* (Canefri) from Darnley Island. The varix on the outer lip, cited by Wenz (1940, p. 804) as a generic character is not diagnostic as it is frequently absent altogether. *A. triplicata* has also been recorded from Abattoirs and Croydon Bores.

Material—One broken specimen, Hindmarsh Bore.

Stratigraphical Range—Kalimnan to Dry Creek Sands.

Geographical Distribution—Gippsland, Victoria, to Adelaide, S.A.

Amaea (Amaea) sp.

A single broken specimen, congeneric with *triplicata*, occurs in Hindmarsh Bore, with four sharp and narrow equal spiral cords and a smaller posterior cord, crossed by about 24 axial costae per whorl. Sufficient material is not available for comparison and accurate diagnosis. The number and character of the spiral cords distinguish the specimen from *triplicata*.

Genus CIRSOTREMA Mörch, 1852.

Cirsotrema Mörch, 1852, Cat. Conchyliol., **1**, p. 49.

Type species (monotypy) *Scalaria varicosum* Lamarck.

Subgenus DANNEVIGENA Iredale, 1936.

Dannevigena Iredale, 1936, Rec. Aust. Mus., 19, p. 303.

Type species (o.d.) *Dannevigena martyr* Iredale.

Cirsotrema (Dannevigena) sp.

A fragment of a *Dannevigena*, consisting of most of the body whorl and portion of the penultimate whorl. The species appears to be very close to the type species *Dannevigena martyr* Iredale. The genus, so far as is known, is restricted to southern Australia.

Material—One broken specimen, Weymouth's Bore.

Genus SCALA Bruguière, 1792.

Scala Bruguière, 1792, Encyc. meth. Vers., 1 (2), p. 532.
(*Epitonium* Röding, 1798, Mus. Bolt., **2**, p. 91.)
(*Cyclostoma* Lamarck, 1799, Mem. Soc. Hist. nat. Paris, p. 74.)
(*Scalaria* Lamarck, 1801, Syst. Anim., p. 88.)
(*Scalarus* Montfort, 1810, Conch. Syst., **2**, p. 294.)
(*Acioma* Leach, 1815, Zool. Miscell., **2**, p. 79.)
Scala Bruguière, 1792, Wenz, 1940, Handb. Paläoz. Gastr., **4**, p. 806 (synonymy).

Type species (s.d. Thiele, 1929) *Turbo scalaris* Linné.

Subgenus HIRTOSCALA Monterosato, 1890.

Hirtoscala Monterosato, 1890, Natur. Sicil., **9**, p. 149.
(*Linctoscala* Monterosato, 1890, *ibid.*)
(*Foveoscala* Boury, 1909, Journ. de Conch., **57**, p. 257.)
(*Acutiscala* Boury, 1909, *ibid.*)
(*Prudentiscala* Iredale, 1936, Rec. Aust. Mus., 19, p. 299.)
Hirtoscala Monterosato, 1890, Wenz, 1940, Handb. Paläoz. Gast., 4, p. 808 (synonymy).

Type species (o.d.) *Scalaria cantrainei* Weinkauff.

Scala (Hirtoscala) sp.

Diagnosis—A small *Hirtoscala* with a large and elevated protoconch of three globose turns. Adult whorls sculptured with about 14 elevated oblique axial ribs per whorl, somewhat extended and angulate posteriorly. Interspaces smooth. Suture deep. Aperture subovate, entire; outer lip without varix.

Observations—In view of the fact that only one juvenile specimen is available of this apparently new species, it is not here described in full. The first whorl of the apex is missing, there are 2 subsequent globose embryonic whorls and three adult whorls. The species is closest to S. (*H.*) *delicatula* (Crosse & Fischer), Recent, South Australia, from which it differs by comparison with the holotype in the British Museum, in having a larger protoconch and fewer axials in the early whorls.

Both the present species and *delicatula* are readily comparable with *cantrainei*, the type species of *Hirtoscala* with which *Acutiscala* is considered by Wenz (1940, p. 808) to be synonymous. The South Australian species are closer to *cantrainei* than to *philippinarum* Sowerby, the type species of *Acutiscala*. The subgenus *Hirtoscala* appears to have a wide distribution in warm seas.

Material—One juvenile, with broken tip, Weymouth's Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Weymouth's Bore, 310-330 feet.

Superfamily PYRAMIDELLACEA.

Family MELANELLIDAE.

Genus MELANELLA Bowdich, 1822.

Melanella Bowdich, 1822, Elem. Conch., 1, p. 27.
(*Melaniella* P. Fischer, 1887, Journ. de Conch., 35, p. 198, *non.* L. Pfeiffer, 1857.)

Type species (monotypy) *Melanella dufresnii* Bowdich ? = *Eulima arcuata* Sowerby.

Subgenus MARGINEULIMA Cossmann, 1888.

Margineulima Cossmann, 1888, Ann. Soc. Malac. Belg., 23, Mem. p. 117.

Type species (o.d.) *Eulima fallax* Deshayes.

Melanella (Margineulima) longiconica (Ludbrook)

Eulima longiconica Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 93, pl. 5, fig. 4; Crespin, 1943, Min. Res. Surv. Bull. 9, p. 95.

Diagnosis—A small *Margineulima* with protoconch of one inconspicuous flattened turn and eight slowly decreasing adult whorls in a height of 5 mm. Suture slightly impressed.

Dimensions—Height 5, diameter 2 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1654.

Material—Holotype.

Stratigraphical Range—Kalimnan (Jemmy's Point Formation)-Dry Creek Sands.

Geographical Distribution—Gippsland, Vic., and Adelaide, S.A.

Melanella (Margineulima) minuticonica (Ludbrook)

Eulima minuticonica Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 93, pl. 5, fig. 5.

Diagnosis—A minute *Margineulima* with protoconch consisting of two conspicuous turns followed by 7 adult whorls in a height of 3·1 mm. Body whorl with an obscure angulation. Aperture pyriform.

Dimensions—Height 3·1, diameter 1·0 mm.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1634.

Observations—No further examples of this species have been recovered since it was described from Abattoirs Bore. The subgenus is represented in the European Eocene-Miocene, and has lingered till recent times in Australia and the Indo-Pacific. *M. (M.) roegerae* is the closest ally in South Australia.

Material—Holotype and 5 paratypes, Abattoirs Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs Bore.

Genus LEIOSTRACA II. & A. Adams, 1853.

Leiostraca H. & A. Adams, 1853, Gen. Rec. Moll., 1, p. 237.

Type species (s.d. Suter, 1913) *Turbo subulata* Donovan = *Strombiformis glabra* Da Costa.

Subgenus LEIOSTRACA s. str.

Leiostraca (Leiostraca) acutissima Sowerby

pl. 3, fig. 2.

Leiostraca acutissima Sowerby, 1866, in Reeve Conch. Icon., 15, *Leiostraca* sp. 10, pl. 2, fig. 10a, b; Hedley, 1913, Proc. Linn. Soc. N.S.W., 38, p. 295.
Leiostraca lesbia Angas, 1871, Proc. Zool. Soc., p. 16, pl. 1, fig. 14.
Strombiformis acutissima Sowerby, Hedley, 1918, Journ. Roy. Soc. N.S.W., 51, supp. p. 100; Cotton & Godfrey, 1938, Mal. Soc. S. Aust., Pub. 1.

Diagnosis—Shell very small and acuminated, 8 whorls in a height of 8 mm.; last whorl one half height of shell. Aperture narrow, sharply angled posteriorly; columella long and straight.

Dimensions—Height 8, diameter 1·5, height of body whorl 4, height of aperture 2 mm.

Type Locality—Sydney Harbour; Recent.

Location of Holotype—B.M. Coll.

Observations—Compared with the holotype, the fossil from the Adelaide Pliocene is a little more slender.

Material—Holotype, one specimen Muddy Creek (Upper), one specimen Altona Coal Shaft, all B.M. Coll.; one specimen and one fragment, Hindmarsh Bore.

Stratigraphical Range—Balcombian to Recent.

Geographical Distribution—N.S.W. and southern Australia.

Genus Niso Risso, 1826.

Niso Risso, 1826, Hist. Nat. Europe Merid., **4**, p. 218.
(*Bonellia* Deshayes, 1838, in Lamarck Hist. Nat. Anim. s. Vert., ed. 2, **8**, p. 286, *non.* Rolando, 1823.)
(*Janella* Grateloup, 1838, Act. Soc. Linn. Bordeaux, **10** (52), p. 191.)

Type species (monotypy) *Niso eburnea* Risso.

Subgenus *Niso* s. str.

Niso (Niso) psila Tenison-Woods

pl. 3, fig. 3.

Niso psila Tenison-Woods, 1880, Proc. Linn. Soc. N.S.W., **4**, p. 18, pl. 1, fig. 6; Tate & Dennant, 1893, Trans. Roy. Soc. S. Aust., **17** (1), p. 222; Harris, 1897, Cat. Tert. Moll. Brit. Mus., 1, p. 272; Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., **1** (2), pp. 115, 138; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100.

Diagnosis—A *Niso* of moderate size, height a little less than three times diameter. Protoconch of 1½ rather high dome-shaped turns followed by 8 narrow flatly increasing adult whorls in a height of 8 mm. Suture linear, impressed. Periphery roundly angulate, umbilicus keeled at the margin. Aperture angulate in front.

Dimensions—Height 7, diameter 3 mm.

Type Locality—Muddy Creek, Victoria.

Location of Holotype—Aust. Mus., Sydney, F 1708.

Observations—Of the scanty material available Adelaide examples appear all to be small; a maximum height of about 13 mm. is indicated. The holotype is apparently juvenile; adult specimens reach a height of over 20 mm.

Material—1 juvenile, 1 incomplete example, Abattoirs Bore; 1 ephebic specimen, Weymouth's Bore.

Stratigraphical Range—Balcombian to Dry Creek Sands.

Geographical Distribution—Gippsland, Vic.-Adelaide, S.A.

Family PYRAMIDELLIDAE.

Genus Syrnola. A. Adams, 1860.

Syrnola A. Adams, 1860, Ann. Mag. Nat. Hist., ser. 3, **5**, p. 405.

Type species (monotypy) *Syrnola gracillima* A. Adams.

Subgenus Syrnola s. str.

Syrnola (Syrnola) tincta Angas

pl. 3, fig. 4.

Syrnola tincta Angas, 1871, Proc. Zool. Soc., p. 15, pl. 1, fig. 11; Hedley, 1918, Journ. Roy. Soc. N.S.W., **51**, supp. p. 98; May, 1921, Check List, p. 98; Ill. Ind., p. 93, pl. 44, fig. 14; Chapman, Crespin & Keble, 1928, Rec. Geol. Surv. Vic., **3** (1), p. 161; Cotton & Godfrey, 1932, S. Aust. Nat., **14** (1), p. 22; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100.
Syrnola michaeli Tenison-Woods, 1877, Proc. Roy. Soc. Tas. for 1876, p. 150.

Diagnosis—A rather solid *Syrnola*, whorls 10, in a height of 6 mm. nearly flat with deeply impressed suture. Protoconch heterostrophic, elevated, early whorls relatively large, body whorl fairly small, subangulate at the periphery.

Dimensions—Height 6, diameter 1 mm.

Type Locality—Off Sow and Pigs Reef, Port Jackson, N.S.W.; Recent.

Location of Holotype—B.M. Coll.

Observations—Except for its occurrence in Abattoirs Bore, only one specimen, a small one of length 3·5 mm. and here figured as hypotype, has been found in the Dry Creek Sands. It has been recorded from the Balcombian of the Sorrento Bore (Chapman, Crespin & Keble, 1928, p. 161). The record needs confirmation.

Material—Hypotype, Weymouth's Bore, 310-330 feet; 3 specimens, Abattoirs Bore.

Stratigraphical Range—Dry Creek Sands to Recent; (?) Balcombian.

Geographical Distribution—New South Wales to Rottnest Island, Western Australia.

Subgenus AGATHA A. Adams, 1860.

Agatha, A. Adams, 1860, Ann. Mag. Nat. Hist., ser. 3, **6**, p. 422.
(*Amathis*, A. Adams, 1861, *id.*, **8**, p. 303.)

Type species (monotypy) *Agatha virgo* A. Adams.

Syrnola (Agatha) praefasciata sp. nov.

pl. 3, fig. 5.

Syrnola bifasciata T. Woods, Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100.

Diagnosis—An *Agatha* of moderate size, spire relatively short, body whorl large, more than half height of shell, evenly convex from posterior suture over periphery and base. Aperture elongate-ovate.

Description of Holotype—Shell of moderate size for the genus, spire relatively short, whorls four, outlines convex. Protoconch heterostrophic, paucispiral, coiled in a low helicoid spiral. Nucleus small and about one-third immersed. Adult whorls five, smooth but for axial growth striae, convex; suture strong, linear, impressed. Body whorl large, more than half height of shell, evenly convex from posterior suture over periphery and base. Aperture elongate-ovate, not expanded anteriorly; outer lip gently concave, somewhat oblique in profile, slightly incurved at posterior angle before attachment to previous whorl. Columella slightly oblique, nearly straight, plait small but distinct and situated about one-third of length from insertion. Base depressed near columella, leading to narrow umbilicus.

Dimensions—Height 5·5, diameter 2·5, height of body whorl 3·5, height of aperture 1·8 mm.

Type Locality—Weymouth's Bore, 310-330 feet.

Location of Holotype—Tate Mus. Coll., F 15166.

Observations—Compared with *bifasciata* with which it was previously identified, the present fossil species has fewer whorls; the body whorl is much longer (in *bifasciata* it is less than one-third height of shell); the aperture is narrower and more elongate and the posterior angle is not acute as in *bifasciata* but joins the previous whorl with a slight inward curve. There is a very close resemblance between *praefasciata* and the type species, *A. virgo*, which has a small protoconch almost entirely immersed. The subgenus is confined to the Pacific, and is well represented in the New Zealand Tertiary (Laws, 1940, pp. 150-153). The genus *Agatha* was introduced monotypically by Adams for *Agatha virgo*, which he later (Ann. Mag. Ser. 3, 7, p. 295) transferred to *Myonia* (introduced prior to *Agatha* and preoccupied by Dana) then (*ibid.*) to *Menesthis*, again (Ann. Mag. ser. 3, 8, p. 142) to *Myonia*, finally (*id.* 8, p. 304) erecting the genus *Amathis*, naming *Myonia virgo* as type. *Amathis* is thus a direct synonym of *Agatha*, but although *A. virgo* has been referred to *Myonia* which was changed to *Adelactaeon* by Cossmann (1895, 1, p. 54) *Myonia* and *Adelactaeon* are not synonyms of *Agatha*. They were introduced for a different group of shells, and are considered by Wenz (1940, p. 850) to be synonymous with *Actaeopyramis* P. Fischer, 1885.

Material—Holotype and 2 paratypes, Weymouth's Bore.

Stratigraphical Range—Dry Creek Sands.
Geographical Distribution—Abattoirs and Weymouth's Bores.

Syrnola (Agatha) jonesiana (Tate)

pl. 3, fig. 6.

Odontostomia jonesiana Tate, 1898a, Trans. Roy. Soc. S. Aust., **22** (1), p. 70.
Odontostomia (Syrnola) jonesiana Tate, 1898b, *id.*, (2), p. 83, text. fig.
Pyramidella jonesiana Tate, Chapman, Crespin & Keble, 1928, Rec. Geol. Surv. Vic., **5** (1), p. 161.
Syrnola jonesiana Tate, Cotton & Godfrey, 1932, S. Aust. Nat., **14** (1), p. 23; 1938, Mal. Soc. S. Aust., **1**, p. 17.

Diagnosis—A small *Agatha* with eight whorls in a height of 6 mm., flat and of moderate width. Suture linear, impressed; base regularly convex; body whorl less than half height of shell, subangulate at the periphery. Columella plait strong and elevated.

Dimensions—Height 6·25, diameter 2·0 mm.
Type Locality—Tintinarra Bore, 26-154 feet.
Location of Holotype—S. Aust. Mus., D 13466.
Material—One specimen, Weymouth's Bore.
Stratigraphical Range—(?) Mid-Tertiary to Recent.
Geographical Distribution—Port Phillip Bay, Victoria-Adelaide, S. Aust.

Syrnola (Agatha) infrasulcata (Tate)

pl. 3, fig. 7.

Odontostomia (Syrnola) infrasulcata Tate, 1898b, Trans. Roy. Soc. S. Aust., **22** (2), p. 83, pl. 4, fig. 5.
Syrnola infrasulcata Tate, Cotton & Godfrey, 1932, S. Aust. Nat., **14** (1), p. 22; 1938, Mal. Soc. S. Aust., **1**, p. 17; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100.

Diagnosis—An *Agatha* of moderate size, with nine whorls in a height of 11 mm. Body whorl subangulate at the periphery, nearly half height of shell, sculptured with about six incised grooves below the periphery and sometimes one or more above the periphery continuing medially on the spire whorls.

Dimensions—Height 11, diameter 3·5 mm.
Type Locality—Holdfast Bay, S. Aust.
Location of Holotype—S. Aust. Mus., Reg. No. D 13465.
Material—The figured hypotype, Weymouth's Bore; one specimen, Hindmarsh Bore.
Stratigraphical Range—Dry Creek Sands to Recent.
Geographical Distribution—Beachport to Spencer Gulf, S. Aust.

Subgenus Puposyrnola Cossmann, 1921.

Puposyrnola Cossmann, 1921, Ess. Paleoconch., **12**, p. 229.

Type species (o.d.) *Auricula acicula* Lamarck.

Syrnola (Puposyrnola) tasmanica (Tenison Woods)

pl. 3, fig. 8.

Stylopygma tasmanica Tenison Woods, 1877, Proc. Roy. Soc. Tas., 1876, p. 151.
Syrnola tasmanica Tenison Woods, May, 1921, Check List, p. 98; Ill. Ind., p. 93, pl. 44, fig. 13; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100; Crespin, 1943, Aust. Min. Res. Surv. Bull. **9**, p. 98.

Diagnosis—A somewhat elongate *Puposyrnola* with 7 adult whorls in a height of 4 mm.; whorls rather tumid, obsoletely striate. Suture almost horizontal, impressed.

Dimensions—Height 4, diameter 1 mm.
Type Locality—Blackman's Bay, Tasmania; Recent.
Location of Holotype—Hobart Museum.
Observations—No further examples of this species have been recovered since it was recorded from Abattoirs Bore. It has been recorded from the Kalimnan of Gippsland (Crespin, 1943, p. 98) and a specimen from the Kalim-

nan of Muddy Creek, Victoria, in the British Museum collection, here figured (pl. 3, fig. 8) is referred to *tasmanica* by comparison with the figure of *tasmanica* (May, 1923, p. 44, fig. 13). No authentic specimens of *tasmanica* have been available for comparison. It is rare in Tasmania and the fossil species may possibly not be identical although it agrees in size and general features.

Material—One specimen, hypotype, Muddy Creek, Vic.; B.M. Coll.

Stratigraphical Range—Kalimnan-Recent.

Geographical Distribution—Recent, Tasmania; Tertiary, Gippsland, Vic.; Adelaide, S. Aust.

Syrnola (Puposyrnola) acrisecta Ludbrook

Syrnola acrisecta Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 92, pl. 5, fig. 2.

Diagnosis—A very small *Puposyrnola* sharply pupiform, with six adult whorls in a height of 3·3 mm. Fairly broad with flattened whorls separated by channelled and impressed suture. Body whorl flat above the periphery which is subangulate. Aperture elongate, pyriform, columella nearly straight with a small fold near the origin.

Dimensions—Height 3·3, diameter 1·1 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1637.

Observations—S. (*P.*) *acrisecta* is the most commonly occurring Syrnolid in the Dry Creek Sands, although like other members of the genus it is not numerous. The subgenus *Puposyrnola* is well represented in the New Zealand Tertiary (Laws, 1937, pp. 307-309) although New Zealand species are all very strongly pupiform. The species *acrisecta* is more like the Paris Basin type species S. (*P.*) *acicula* than the New Zealand species.

Material—Four specimens, Weymouth's Bore; one specimen, Hindmarsh Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Adelaide district.

Subgenus Evelynella Laws, 1940.

Evelynella Laws, 1940, Trans. Roy. Soc. N.Z., **70** (2), p. 153.

Type species (o.d.) *Evelynella venustas* Laws.

Syrnola (Evelynella) adelaidensis sp. nov.

pl. 3, fig. 9.

Diagnosis—A fairly large *Evelynella* with six adult whorls in a height of 4·8 mm. Whorls flatly convex, fairly wide with linear, impressed suture. Body whorl nearly half height of shell, subangulate at periphery. Outer lip arcuate with several lirations deeply within.

Description of Holotype—Shell fairly large for the genus solid, conical, smooth except for faint axial growth striae, shining. Protoconch small, of about 1½ turns, heterostrophic, tip immersed. Adult whorls six, flatly convex, fairly wide; suture linear, impressed. Body whorl large, nearly half height of shell, subangulate at the periphery, flatly convex above the periphery, base convex below the periphery, with an umbilical chink. Aperture subovate, expanded below and angulate above. Columella vertical, arcuate, with a strong horizontal plait near the origin. Outer lip thin, straight when viewed in profile, arcuate, with about ten lirations deeply within visible only in reflected light.

Dimensions—Height 4·8, diameter 2, height of body whorl 2 mm.

Type Locality—Hindmarsh Bore, 450-487 feet.

Location of Holotype—Tate Mus. Coll., F 15167.

Observations—It is interesting to find this New Zealand Tertiary subgenus among Adelaide specimens. As Laws points out in his diagnosis of the genus

(1940, p. 153), the form of the body whorl with somewhat disproportionate width of the aperture in addition to the very characteristic lirae within the outer lip, serve to distinguish the subgenus from other Syrnolids.

Material—Holotype, Hindmarsh Bore; 2 paratypes, one broken, one juvenile, Weymouth's Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Hindmarsh and Weymouth's Bores, Adelaide.

Genus TURBONILLA Risso, 1826.

Turbonilla Risso, 1826, Hist. Nat. Europe merid., 4, p. 224.

Type species (s.d. Dall & Bartsch, 1909) *Turbonilla typica* Dall & Bartsch = *T. plicatula* Risso *non.* Brocchi.

Subgenus TURBONILLA s. str.

Turbonilla (Turbonilla) mariae Tenison Woods

pl. 3, fig. 10.

Turbonilla mariae Tenison Woods, 1876, Proc. Roy. Soc. Tas., 1875, p. 144; May, 1921, Check List, p. 99; May, 1923, Ill. Ind., p. 93, pl. 44, fig. 29; Cotton & Godfrey, 1932, S. Aust. Nat., 14 (1), p. 30.

Turbonilla cf. *mariae* T. Woods, Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 100.

Diagnosis—A *Turbonilla* with a large protoconch of 1½ heterostrophic turns followed by one-half turn with brephic axials. Twelve whorls in a height of 10 mm. with 16 axial ribs on the penultimate whorl. Ribs become obsolete on the periphery but the interspaces are not abruptly terminated at the periphery. Base smooth.

Dimensions—Height 10, diameter 2 mm.

Type Locality—King Island, Bass Strait; Recent.

Location of Holotype—Hobart Museum, Tasmania.

Observations—Adelaide specimens are conspecific with specimens of *T. mariae* from Tasmania in the British Museum. All of these specimens are small as compared with the holotype, and have 10 adult whorls in a height of 7 mm.

Material—Three specimens, one juvenile, Hindmarsh Bore; four specimens, Recent, Tasmania, B.M. Coll.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Tasmania to MacDonald Bay, S. Aust.

Turbonilla (Turbonilla) sp.

An immature *Turbonilla* with a large protoconch and 3 adult whorls more finely sculptured than *T.* (*T.*) *mariae*.

Material—One specimen, Weymouth's Bore.

Subgenus CHEMNITZIA d'Orbigny, 1839.

Chemnitzia d'Orbigny, 1839, in Webb & Berthelot Hist. Nat. Canaries, p. 77.

Type species (monotypy) *Melaniella campanellae* Philippi

Turbonilla (Chemnitzia) mappingae sp. nov.

pl. 3, fig. 11.

Diagnosis—A *Chemnitzia* of moderate size, stout and thick with nine adult whorls in a height of 5·25 mm., shouldered at the posterior summit and slightly medially depressed. Sculptured with strong axial ribs, 13 on the first and second whorls, 14 on the succeeding whorls. Ribs practically continuous from whorl to whorl.

Description of Holotype—Shell of moderate size, elongate-conical, stout and thick. Protoconch missing, adult whorls nine in a height of 5·25 mm.; whorls shouldered at the posterior summit, somewhat contracted at the periphery, and slightly medially depressed. Sculpture of strong axial ribs, slightly narrower than the interspaces increasing from 13 on the first and second whorls to 14 on

the succeeding whorls; ribs practically continuous from whorl to whorl. Intercostal spaces wider than ribs, fairly deeply sunk and abruptly terminated on the periphery. Base short only slightly rounded; aperture small, broken in the holotype, but apparently subquadrate. Columella short, straight, slightly oblique.

Dimensions—Height 5·25, diameter 1·5, height of body whorl, 1·8 mm.

Type Locality—Weymouth's Bore, Adelaide, 310-330 feet.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, F 15168.

Material—Holotype and last 3 whorls of one paratype, a larger shell than the holotype, Weymouth's Bore; paratype, Abattoirs Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Weymouth's and Abattoirs Bores.

Turbonilla (Chemnitzia) wurongae sp. nov.

pl. 3, fig. 12.

Diagnosis—A slowly tapering *Chemnitzia* with eight adult whorls in a height of 6·2 mm. Whorls flat to slightly convex, sculptured with 12 axial ribs per whorl, 14 on the body whorl; intercostal spaces much narrower than ribs, elongate triangular with apex at the posterior extremity and not very deep. Aperture subquadrate; outer lip vertical, columella straight, vertical.

Description of Holotype—Shell of moderate size, elongate. Conical, slowly tapering, stout and thick. Protoconch missing, adult whorls 8 in a height of 6·2 mm. Whorls flat to slightly convex, suture linear, impressed. Sculpture of 12 flatly rounded axial ribs per whorl, 14 on the body whorl. Intercostal spaces much narrower than ribs, elongate-triangular with apex at the posterior extremity, and not very deep, terminated abruptly just above the periphery. Base smooth, of moderate height, slightly rounded. Aperture subquadrate; outer lip vertical, columella straight, vertical.

Dimensions—Height, 6·2, diameter 1·5, height of body whorl 1·35 mm.

Type Locality—Hindmarsh Bore, 450-487 feet.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, F 15169.

Observations—This species is distinguishable from the previous species, *T. (C.) mappingae*, by its more tapering shape, flatter whorls, not shouldered below the suture, and fewer ribs with relatively narrow interspaces on each whorl. The aperture also differs principally in the orientation of the columella.

Material—Holotype and one paratype, Hindmarsh Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Hindmarsh Bore, Adelaide.

Turbonilla (Chemnitzia) subfusca Ludbrook

Turbonilla subfusca Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 93, pl. 5, fig. 7.

Diagnosis—A very small *Chemnitzia* with a protoconch of 2 globose helicoid turns set at right angles to the rest of the shell and partly immersed. Seven adult whorls in a height of 5·1 mm. First two adult whorls convex and without sculpture, except for inconspicuous axial striae, third whorl with axial costae developing, 14 in number, 16 on the penultimate whorl, somewhat oblique and equal to the interspaces. Aperture subquadrate, outer lip and columella vertical.

Dimensions—Height 5·1, diameter 1·0 mm.

Type Locality—Abattoirs Bore, Adelaide.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1668.

Observations—No further examples of this species have been found since it was described from Abattoirs Bore. It is readily distinguishable by the smooth and convex large whorls, together with the protoconch, if it is preserved, of 2 separately globose helicoid turns laterally situated at right angles to the rest of the shell.

Material—Two paratypes, Abattoirs Bore; one specimen, Hindmarsh Bore.

Stratigraphical Range—Dry Creek Sands.
Geographical Distribution—Abattoirs Bore, Adelaide.

Turbonilla (Chemnitzia) adelaidensis sp. nov.

pl. 3, fig. 13.

Diagnosis—An elongate *Chemnitzia*, slowly tapering, with 13 adult whorls and protoconch in a height of 10·5 mm. Adult whorls slightly convex, particularly in first 6 whorls, sculptured with numerous slightly oblique axial costae, rounded and about equal to interspaces, 17 on the first 2 whorls, 14 on whorls 3-8, 15 on the 9th whorl, 17 on the 10th and 11th, and 20 on the penultimate whorl.

Description of Holotype—Shell fairly large, moderately thick, elongate-subulate, slowly tapering. Protoconch prominently heterostrophic of 2 globose helicoid turns tilted at about 60 degrees to the axis. Nucleus projecting with suture of first whorl tangential to it. Adult whorls 13, slightly convex, more so in the first 6 whorls; sculptured with numerous slightly oblique axial costae, rounded and about equal to the interspaces, extending from suture to suture on the spire whorls and terminated at the periphery of the body whorl. There are 17 costae on the first 2 whorls, 14 on whorls 3-8, 15 on the 9th whorl, 17 on the 10th and 11th and 20 on the penultimate. Interspaces abruptly terminated just above the sutures and on the periphery on the body whorl, suture linear, impressed. Base smooth, moderately convex, aperture subquadrate, columella and outer lip parallel and vertical; outer lip slightly broken in the holotype.

Dimensions—Height 10·5, diameter 2, height of body whorl 2·1 mm.

Type Locality—Weymouth's Bore, 310-330 feet.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, F 15170.

Observations—This is an elegant and elongate *Chemnitzia* somewhat resembling *T. (C.) subfusca*. It is readily separable by its greater length and sculptured early whorls and greater number of costae.

Material—Holotype, Weymouth's Bore; one paratype (incomplete), Hindmarsh Bore; 3 paratypes, Abattoirs Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Adelaide District.

Turbonilla (Chemnitzia) currongae sp. nov.

pl. 3, fig. 16.

Diagnosis—A very small *Chemnitzia* with protoconch and 7 adult whorls in a height of 3·75 mm. Protoconch high at about 75 degrees to the axis with nucleus lateral, globose and partly immersed. Adult whorls shouldered at the summit with strong oblique axial ribs narrower than interspaces, increasing from 12 on the first to 20 on the penultimate whorl.

Description of Holotype—Shell very small elongate, conical. Protoconch heterostrophic, high and fairly large, of 2 helicoid turns set at about 75 degrees to the axis; nucleus prominent, lateral and slightly immersed. Protoconch followed by one-half turn with brephic axials. Adult whorls 7 fairly rapidly increasing, shouldered at the summit and flat, sculptured with strong, sharply defined axial costae slightly narrower than the interspaces, which are flat and obliquely set across the whorls at an angle of 60 degrees; there are 12 on the first, 14 on the second, 16 on the third, 18 on the fourth and fifth, and 20 on the penultimate and body whorls. Interspaces extend from suture to suture on the spire whorls, but are abruptly terminated on the periphery of the body whorl. Base smooth, convex, steeply inclined. Aperture subquadrate, slightly effuse anteriorly; columella almost vertical, outer lip slightly oblique.

Dimensions—Height 3·75, diameter 1·2, height of body whorl 1·2 mm.

Type Locality—Hindmarsh Bore, 450-487 feet.

Location of Holotype—Tate Mus. Coll., F 15171.

Observations—The number of costae, set noticeably obliquely, and the shouldering of the whorls separate this species from other species of *Chemnitzia* herein described.

Material—Holotype and one fragment of paratype, Hindmarsh Bore; one paratype, Abattoirs Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Hindmarsh and Abattoirs Bores, Adelaide.

Turbonilla (Chemnitzia) widningae sp. nov.

pl. 3, figs. 14, 15.

Diagnosis—A *Chemnitzia* of moderate size, with moderately convex whorls sculptured with 16 axial ribs per whorl. Interspaces subrectangular, not terminated above the suture, but terminated on the periphery of the body whorl. Base oblique and flatly convex. Aperture subquadrate, columella slightly oblique to the left, outer lip not parallel to columella, vertical.

Description of Holotype—Shell of moderate size, elongate-tapering, solid, fairly thick. Protoconch and early whorls missing, 7 adult whorls remaining, moderately convex, sculptured with flatly rounded axial ribs, slightly wider than interspaces, oblique to gently curved, 16 per whorl, 18 on the body whorl. Interspaces subrectangular extending from suture to suture in the spire whorls and terminated abruptly on the periphery of the body whorl. Base short, smooth, oblique and flatly convex. Aperture small, base of columella and outer lip broken.

Dimensions—Height 5·6 (estimated total height 9), diameter 1·5, height of body whorl 1·8 mm.

Paratype—Portion of shell with body whorl and aperture complete. Aperture subquadrate; columella oblique to the left; outer lip vertical, lip slightly effuse anteriorly.

Type Locality—Hindmarsh Bore, 450-487 feet.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, F 15172.

Observations—This species is close to *T. (C.) wurongae* from which it differs in the number of costae per whorl and the shape of the interspaces. In *wurongae* the interspaces are elongate-triangular, with the apex of the triangle below the suture; in *widningae* they are rectangular and not terminated above the suture.

Material—The holotype and 2 paratypes.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Hindmarsh Bore, Adelaide.

Turbonilla (Chemnitzia) sp.

It is impossible fully to describe this small *Chemnitzia* from Hindmarsh Bore of which only the three last whorls remain. The whorls are flatly convex and finely sculptured with 22 axial costae per whorl. The costae are oblique, extend from suture to suture and are separated by narrower interspaces. The interspaces are continuous from suture to suture, but are abruptly terminated at the periphery of the body whorl. The aperture is broken but appears to be subquadrate, the columella vertical. The base is smooth, flatly oblique.

The subgenus *Chemnitzia* has been recorded and the species described above for the first time from the Australian Tertiary. All of the species of which the protoconch is preserved fall into "Group A" of Laws (1937a, p. 407; 1937b, p. 49) in which the protoconch is helicoid and the intercostal grooves abruptly terminated at the periphery. *Chemnitzia* "Group A", with 2 doubtful exceptions, does not appear in New Zealand before the Nukumaruan, although *Chemnitzia* including "Group B" characterised by a planorboid protoconch appeared as early as the Hutchinsonian. It is impossible to state at this stage whether *Chemnitzia* is represented in the Australian Tertiary before the Pliocene; so far as can be

determined from figures of poorly preserved specimens described under *Turbonilla*, it is not represented.

Subgenus PYRGOLAMPROS Sacco, 1892.

Pyrgolampros Sacco, 1892, Moll. Terr. Terz. Piem. II, p. 65.
(*Pyrgolamprus* Cossmann, 1921 (emend. pro. *Pyrgolampros* Sacco) Ess. Paleo. Comp., **12**, p. 287.)

Type species (o.d.) *Pyrgolampros mioperplicatulus* Sacco.

Turbonilla (Pyrgolampros) vixcostata Ludbrook

Turbonilla vixcostata Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 92, pl. 5, fig. 6.

Diagnosis—A *Pyrgolampros* fairly large, solid but thin, 12 adult whorls in a height of 13 mm. sculptured with about 14 axial costae per whorl on the early whorls. Costae become weaker and gradually obsolete after the sixth whorl and disappear altogether. Aperture elongate quadrate, columella slightly plicate; aperture somewhat effuse anteriorly.

Dimensions—Height 9·8; diameter 2·2 mm.

Type Locality—Abattoirs Bore, Adelaide.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1659.

Observations—The holotype is a young shell, a typical if incomplete example reaches a height of 13 mm., diameter 3·5 mm. The species is numerous and common, and is readily distinguished by the absence of sculpture except for growth lines in the later whorls.

Material—About 55 paratypes, mostly broken, Abattoirs Bore; 10 specimens, Hindmarsh Bore; 3 specimens, Weymouth's Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Adelaide District.

Turbonilla (? Pyrgolampros) sp.

? Turbonilla sp. Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 93.

Observations—No further examples of this species have been recovered, and the precise location is still indeterminable.

Subgenus PYRGISCUS Philippi, 1841.

Pyrgiscus Philippi, 1841, Arch. Naturgesch., 7 (1), p. 50.
(*Pyrgostelis* Monterosato, 1884, Nom. Gen. Spec., p. 89.)
(*Ortostelis* Aradas and Maggiore, 1843, Atti. Acad. Giov. Catania, **20**, p. 118.)

Type species (s.d. Dall & Bartsch, 1909) *Melania rufa* Philippi.

Turbonilla (Pyrgiscus) "liraecostata" Tenison Woods

Turbonilla liraecostata Tenison Woods, 1877, Proc. Roy. Soc. Tas., 1876, p. 101.
Turbonilla liraecostata T. Woods, Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., **1** (2), p. 116.
Turbonilla liraecostata T. W. Chapman, Crespin & Keble, 1928, Rec. Geol. Surv. Vic., **5** (1), p. 160.
Turbonilla liraecostata T. Woods, Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100.

Diagnosis—A small *Pyrgiscus* with 8 adult whorls and a small protoconch in a height of 5·5 mm. Whorls flattened with 20-24 straight rounded ribs; intercostal spaces narrower than ribs and closely spirally grooved. Base roundly convex and spirally lirate.

Dimensions—Length 5·5, diameter 1·5 mm.

Type Locality—Table Cape, Tasmania; "Janjukian".

Location of Holotype—? Hobart Museum, Tasmania.

Observations—The identification of this species is based on the description only. Present study is limited to one juvenile with 5 adult whorls which must be regarded as doubtfully *liraecostata*. The species has previously been recorded from the Kalimnan of the Sorrento Bore (Chapman, Crespin & Keble, 1928, p. 160), but all identifications of this species in Victoria and South Australia need further study and comparison with the type for confirmation.

Material—One juvenile specimen, Hindmarsh Bore.

Stratigraphical Range—"Tertiary".

Geographical Distribution—Port Phillip Bay, Victoria, to Adelaide, S. Aust.; Tasmania.

Turbonilla (Pyrgiscus) radicans Chapman & Crespin

Turbonilla radicans Chapman & Crespin, 1928, Rec. Geol. Surv. Vic., **5** (1), p. 109, pl. 7, fig. 35; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100; Crespin, 1943, Aust. Min. Res. Surv. Bull. **9**, p. 99.

Diagnosis—A very small *Pyrgiscus* with six flattened adult whorls and a small protoconch of 2 turns in a height of 3·7 mm. Sculpture of 14 axial costae per whorl, with intercostal spaces narrower than ribs, transversely striated, the striae passing over the ribs.

Dimensions—Height 3·7, diameter 1·16 mm.

Type Locality—Sorrento Bore, Victoria, 670 ft., Kalimnan.

Location of Holotype—Geol. Surv. Vic. Coll.

Material—One example, worn, Tennant's Bore; one worn example, Weymouth's Bore.

Stratigraphical Range—"Tertiary".

Geographical Distribution—Gippsland, Vic.-Adelaide, S. Aust.

Turbonilla (s.l.) spp.

Two fragments each consisting of the body and portion of the penultimate whorl were obtained from Hindmarsh Bore. It is possible that they belong to the subgenus *Pyrgiscilla* (Laws, 1937c, p. 172). The intercostal grooves are stopped at the periphery as in *Chemnitzia* and there is a suggestion of spiral striations on the intercostal spaces. However, sufficient material is not available for confirmation. The two fragments differ in the number of costae, and are not conspecific.

Superfamily HIPPONICACEA.

Family HIPPONICIDAE.

Genus CHEILEA Modeer, 1793.

Cheilea Modeer, 1793, K. Vetens. Acad. Handl., **14**, p. 112.
(*Mitralaria* Schumacher, 1817, Ess. Vers. test., pp. 56, 183.)
(*Lithodaphus* Owen, 1842, Proc. Zool. Soc., p. 147.)
(*Calyptra* H. & A. Adams, 1854, Gen. Rec. Moll., **1**, p. 304.)

Type species (s.d. Woodring, 1928) *Patella equestris* Linné.

Cheilea adelaidensis Ludbrook

Cheilea adelaidensis Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 94, pl. 5, figs. 8, 9; 1941, *ibid.*, p. 100.

Diagnosis—Apex anterior, sharply curved in two turbinate whorls; shell smooth in the neighbourhood of the apex, central portion forming a cap with steep sides, rest of shell flattened and irregular. Sculpture from edge of smooth portion surrounding apex to adult area of numerous, very fine, waving, radial lirae wider than interspaces broken by irregular concentric lines of growth and crossed irregularly by diagonal radial grooves.

Dimensions (of cap)—Height 4, diameter 6 mm.

Paratype—The internal appendage of the paratype is semi-circular in basal outline, convex in front, fairly wide and showing irregular growth lines.

Observations—No further examples of this species have been obtained since it was described from Abattoirs Bore. The genus is widespread in warmer waters. The species was inadvertently listed as *C. pliocenica* (Ludbrook, 1941, p. 100), *pliocenica* being a nomen nudum. The species was described (p. 94) under the name *adelaidensis*.

Material—Holotype T 1666, and paratype T 1667.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Abattoirs Bore, Adelaide.

Genus Hipponix Defrance, 1819.

Hipponix Defrance, 1819, Bull. Sci. Soc. Philom. Paris, Jan., p. 8.
(*Hipponyx* Crosse, 1862, Journ. de Conch., **10**, p. 17.)
(*Cochlolepas* H. & A. Adams, 1854, Gen. Rec. Moll., **1**, p. 373.)

Type species (s.d. Gray, 1847) *Patella cornucopia* Lamarck.

Subgenus Sabia Gray, 1847.

Sabia Gray, 1847, Proc. Zool. Soc., p. 157.
(*Amalthea* Schumacher, 1817, Ess. Vers. test., pp. 56, 181, *non* Rafinesque, 1815.)
(*Sabina* Zittel, 1882 (*err. pro Sabia* Gray) Handb. Pal., **2**, p. 216.)
(*Capulonix* Iredale, 1929a, Mem. Qld. Mus., **9**, p. 277.)
(*Saptadanta* Prashad & Rao, 1934, Rec. Ind. Mus., **36**, p. 1.)

Hipponix (Sabia) conicus (Schumacher)

pl. 4, figs. 1-4.

Amalthea conica Schumacher, 1817, Ess. Vers. test., p. 181, pl. 21, fig. 4.
Patella australis Lamarck, 1819, Hist. Nat. Anim. s. Vert., **6** (1), p. 335; Delessert, 1841, Rec. Coq., pl. 23, fig. 11.
Hipponix australis Lamarck, Quoy and Gaimard, 1835, Voy. Astrolabe Zool., **3**, p. 434, pl. 72, figs. 25-34; Crosse, 1862, Journ. de Conch., p. 21; Tate, Trans. Roy. Soc. S. Aust., **17**, p. 330; Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., **1** (2), pp. 138, 144.
Hipponyx conicus Schumacher, Crosse, *ibid.*, p. 24; Godfrey, 1931a, S. Aust. Nat., **12** (2), p. 31, pl., fig. 12.
Amalthea conica probably = *Amalthea australis* Quoy, Angas, 1865b, Proc. Zool. Soc., p. 175.
Sabia conica Schumacher, Cotton & Godfrey, 1938, Mal. Soc. S. Aust., **1**, p. 18; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100.

Diagnosis—A *Sabia* of variable shape, generally high, shell thick, apex posterior and directed posteriorly, smooth, sharp and incurved at tip. Sculpture of irregular radial ribs with narrow interspaces.

Description of Holotype—Shell small, rather elevated, conical, convex; apex high, smooth, posterior, directed backwards over the margin, eroded in the holotype. Exterior surface coarsely sculptured with irregular, wide, flat radial ribs, with narrow sublinear interspaces, bifurcating towards the apertural border. Aperture subcircular in the holotype; interior smooth with a long, horseshoe-shaped posterior muscular impression near the margin.

Dimensions—Height 10, antero-posterior diameter 12, lateral diameter 12 mm.

Type Locality (here designated)—Tasmania; Recent.

Location of Holotype—Zoologiske Museum, Kobenhavn, Schumacher, 181, No. 1071.

Observations—The synonymy of this species and that of the species recorded as *Capulus australis* are confused in Australian literature. There appears to be failure to recognise that the species redescribed by Quoy and Gaimard was Lamarck's *Patella australis*, figured by Delessert. Lamarck's original description was republished together with Quoy and Gaimard's more detailed description of the "Astrolabe" hypotypes. Godfrey (1931a, p. 31) has synonymized *Hipponyx australis* Quoy & Gaimard (*sic*) with *Amalthea conica* Schumacher, and later (1931b, p. 44) has used *Capulus australis* Lamarck for the species of *Capulus* previously known in South Australia as *Capulus danieli* Crosse. This shell is not Lamarck's *Patella australis*. It is a thin, somewhat irregular shell with a recurved apex, and has very weak and fine radial sculpture visible in oblique light in contrast with Lamarck's species of which the radial ribbing is clearly shown in Delessert's figure. Angas (1865, p. 175) considered it identical with *Capulus danieli* Crosse; one example only and four topotypes of *C. danieli* are available in the British Museum Collection so that exact comparison is difficult, but there is close resemblance between the two. Unless morphological differences are established, the Recent species recorded in South Australia as *Capulus australis* should be identified with *Capulus danieli*.

The fossil *Hipponix* (*Sabia*) *conica* is small, like the holotype which the

writer has been privileged to see by the courtesy of the Zoologiske Museum, Kobenhavn. The species is very variable in form and sculpture of the shell.

The holotype of *Patella australis* cannot be located (Mermod, 1950, p. 700), but is considered by Mermod to be probably a *Sabia*.

Capulonix Iredale has been included above in the synonymy of *Sabia*. This name was introduced by Iredale for the Queensland shell listed by Hedley as *Capulus calyptra* Martyn. No specimens of the Queensland shell are available for present study, but Martyn's figure appears to be that of a *Sabia*. The specific determination of the Queensland species may be erroneous, as Martyn's figured specimen (Martyn, 1784, 1, pl. 18) was recorded by the author as from the north-west coast of America.

Material—The holotype : figured hypotype (worn), Hindmarsh Bore; numerous specimens, Recent, South Australia. B.M. Coll.

Stratigraphical Range—Dry Creek Sands-Recent.

Geographical Distribution—Southern Australia.

Superfamily CALYPTRAEACEA.

Family TRICHOTROPIDAE.

Subfamily TRICHOTROPINAE.

Genus CERITHIODERMA Conrad, 1860.

Cerithioderma Conrad, 1860, Journ. Acad. Nat. Sci. Philad., ser. 2, 4, p. 295.
(*Mesostoma* Deshayes, 1864, Descr. Anim. s. Vert. Bass. Paris, Supp. 2, p. 416 (*non* Dujardin, 1930).)

Type species (monotypy) *Cerithioderma prima* Conrad.

Cerithioderma accrescens (Tate)

Trichotropis accrescens Tate, 1890b, Trans. Roy. Soc. S. Aust., 13 (2), p. 189, pl. 12, fig. 11; Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., 1 (2), p. 111; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100.

Diagnosis—A fairly large *Cerithioderma* with seven whorls in a height of 11·5 mm. Whorls rapidly increasing, body whorl large. Sculpture of five equal and equidistant elevated spiral lirae, with a sixth at the anterior suture, crossed by strong high axial lirae, approximately equal to the interspaces, ten in one mm. on the penultimate whorl. Base with 10 raised sharp lirae crossed by axial arcuate striae.

Dimensions—Height 11·5, diameter 5·5, height of aperture 4·5 mm.

Type Locality—Muddy Creek, Hamilton, Victoria; Miocene.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 763A.

Observations—No further examples of this species have been found since it was recovered from Abattoirs Bore. The species is an undoubted *Cerithioderma*; Tate (1890b, p. 185) recognized its affinities with Deshayes's *Mesostoma*, which he considered a synonym of *Trichotropis*. *Cerithioderma*, with which Deshayes's *Mesostoma* is synonymous, is well represented in the European Eocene, and *C. accrescens* is very like *C. reticulatum* Wrigley from the Bracklesham Beds. The genus is distributed in the Upper Cretaceous to Oligocene of Europe and North America, and appears to have lingered on in Australia through Miocene and Pliocene times.

Material—Holotype.

Stratigraphical Range—Miocene-Dry Creek Sands.

Geographical Distribution—Muddy Creek, Victoria-Adelaide, S. Aust.

Family CAPULIDAE

Subfamily CAPULINAE.

Genus CAPULUS Montfort, 1810.

Capulus Montfort, 1810, Conch. Syst., **2**, p. 54.
(*Pileopsis* Lamarck, 1822, Hist. Nat. Anim. s. Vert., **6** (2), p. 16.)

Type species (monotypy) *Patella hungarica* Linné.

Subgenus CAPULUS s. str.

Capulus (Capulus) circinatus Tate (?)

pl. 4, figs. 5, 6.

Capulus circinatus Tate, 1893b, Trans. Roy. Soc. S. Aust., 17, p. 334, pl. 7, fig. 8; Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., 1 (2), p. 113; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100.

Diagnosis—A small, high *Capulus* with a spirally recurved apex overhanging the posterior border of the aperture. Aperture roundly ovate, sides slightly compressed. Sculpture of fine radial threads crossed by concentric folds and threads which are arched anteriorly.

Dimensions—Height 3·25, greatest diameter 2·5, lesser diameter 2 mm.

Type Locality—Adelaide Bore; Eocene.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1445.

Observations—Three examples referred to this species, from Abattoirs Bore, are all worn. The species depends on the unique holotype from the Eocene of the Adelaide Bore and appears to be a true *Capulus*. The apex is not laterally curved as in *Krebsia* (with which *Tempetasus* Iredale is synonymous) and the shell is similar in shape and in the curvature of the apex to young examples of the type species, *C. hungaricus*; adult *hungaricus* is more circular in shape, and the apex is less strongly curved in the later stages. *Capulus danieli* Crosse is also a *Capulus* s. str. Australian fossil species recorded under this name need re-examining with a view to establishing their exact identity.

Material—3 specimens, including figured hypotype, Abattoirs Bore.

Stratigraphical Range—Eocene-(?)Dry Creek Sands.

Geographical Distribution—Adelaide, South Australia.

Family CALYPTRAEIDAE.

Genus CALYPTRAEA, Lamarck, 1799.

Calyptraea Lamarck, 1799, Mem. Soc. Hist. Nat. Paris, p. 78.
(*Mitrula* Gray, 1821, London Med. Repos., **15**, p. 232.)
(*Mitella* Leach, 1847, in Gray Ann. Mag. Nat. Hist., **20**, p. 271.)

Type species (monotypy) *Patella chinensis* Linné.

Subgenus SIGAPATELLA Lesson, 1830.

Sigapatella Lesson, 1830, Voy. Coquille. Zool., 2 (1), p. 389.
(*Haliotidea* Swainson, 1840, Treat. Malac., p. 354.)
(*Trochella* Gray, 1867, Proc. Zool. Soc., p. 735.)

Type species (s.d. Gray, 1847) *Calyptraea* (*Sigapatella*) *novaezelandiae* Lesson.

Calyptraea (Sigapatella) crassa Tate

pl. 4, figs. 7, 8.

Calyptraea crassa Tate, 1893b, Trans. Roy. Soc. S. Aust., 17, p. 332, pl. 7, figs. 2, 7; Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., 1 (2), p. 138.
Sigapatella crassa Tate, Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100; Crespin, 1943, Dept. Supp. & Ship. Min. Res. Surv. Bull. 9, p. 98.

Diagnosis—A rather stout *Sigapatella* with an elevated subcentral spire, rapidly increasing. Apex prominent, small, oblique, circinately coiled. Body whorl flatly convex; sculpture of fine, lamellose growth lines. Edge of septum concave.

Dimensions—Height 11, diameters 27 and 25 mm.

Type Locality—Gippsland Lakes, Victoria; Kalimnan.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1432A.

Observations—All material available from the bores consists of young thin shells as compared with type specimens. The species occurs in some numbers in Hindmarsh and Abattoirs Bores.

Material—The figured hypotype and 19 specimens, Hindmarsh Bore; 5 specimens, Weymouth's Bore.

Stratigraphical Range—Kalimnan-Dry Creek Sands.
Geographical Distribution—Gippsland, Victoria-Adelaide, South Australia.

Genus CREPIDULA Lamarck, 1799.

Crepidula Lamarck, 1799, Mem. Soc. Hist. Nat. Paris, p. 78.
(*Proscenula* Perry, 1811, Conch., pl. 53.)
(*Sardalium* Schumacher, 1817, Syst. Vers. test., p. 183, *non* Oken, 1815.)
(*Proxenula* Ferussac, 1820, Journ. de Physique, 90, p. 285.)
(*Crypta* Gray, 1847, Proc. Zool. Soc., p. 157.)

Type species (monotypy) *Patella fornicata* Linné.

Subgenus ZEACRYPTA Finlay, 1927.

Zeacrypta Finlay, 1927, Trans. N.Z. Inst., **57**, p. 393.

Type species (o.d.) *Crepidula monoxyla* Lesson.

Crepidula (Zeacrypta) immersa Angas

pl. 4, figs. 9-11.

Crepidula immersa Angas, 1865a, Proc. Zool. Soc., p. 57, pl. 2, fig. 12.
Crepidula unguiformis Lamarck, Tate, 1893b, Trans. Roy. Soc. S. Aust., **17**, p. 330; Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., 1 (2), pp. 144, ? pp. 113, 138; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 100.
Zeacrypta immersa Angas, Godfrey, 1931b, S. Aust. Nat. 12 (3), p. 43; Cotton & Godfrey, 1938, Mal. Soc. S. Aust., 1, p. 18.

Diagnosis—Shell irregular in shape but generally flatly oval, thin, large in size, apex subcentral generally immersed, small, not prominent. Septum thin with straight margin.

Dimensions—Length 27, width 18, height 5 mm.

Type Locality—Port Lincoln, S. Aust., on dead *Pinna*; Recent.

Location of Holotype—Brit. Mus. (Natural History).

Observations—The habit, shared by several species of *Crepidula*, of assuming a flat or backwardly curved shape principally when inhabiting the outer lip of other shells, has led to the assumption that *C. unguiformis* Lamarck is a cosmopolitan species. It has been thus identified throughout Australian Tertiary, and it must be admitted that it is difficult if not impossible to separate the flat forms from *unguiformis* without the supporting evidence of the convex forms, which generally grow on the external surface of dead shells and adjust their shape to the species to which they are attached.

The subgenus *Janacus* Mörch (type species *Crepidula plana* Say) is retained by Wenz (1940, p. 905) for the flat shells.

Finlay (1927, p. 393) created *Zeacrypta*, as a subgenus of *Maoricrypta*, for "the series of slipper limpets that live inside dead shells", naming *Crepidula monoxyla* as type species with the added generic diagnosis of a "brephic stage which forms a slightly raised ellipsoidal cap (with the flatly coiled smooth embryo at one of the foci) ornamented all over with fine threads radiating from the umbo". For the first criterion, that of habit, the name *Janacus* is already available; for the second, the habit of forming a cap, seen in some specimens only, has been observed by the writer without any very close study of the genus in the species *C. fornicata* Linné, *C. aspera* Dunker, *C. unguiformis* Lamarck, *C. norrisianum* Williamson, *C. plana* Say, *C. oryx* Sowerby. It does not then appear to be subgenerically diagnostic. However, *Zeacrypta* is separable from *Janacus* by the fact that the septum has a straight or but slightly curved margin while in *Janacus* there is usually a definite notch on the left side.

Adelaide specimens include both the convex and flat forms, each of which is figured (pl. 4, figs. 9-11). The species attains a large size, one broken specimen from Hindmarsh Bore having an estimated total length of 55 mm., width 40 mm.

Material—Nine specimens including the figured hypotypes, Hindmarsh Bore; two specimens, Kooyonga Bore; one specimen, Tennant's Bore.

Stratigraphical Range—Dry Creek Sands.

Geographical Distribution—Southern Australia.

Crepidula (Zeacrypta) dubitabilis Tate

pl. 4, fig. 12.

Crepidula dubitabilis Tate, 1893b, Trans. Roy. Soc. S. Aust., pl. 9, fig. 5; Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., 1 (2), p. 113, 138; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 100.

Diagnosis—A small *Crepidula*, thin elongate-oval in shape, generally convex. Apex spiral, submarginal.

Dimensions—Length 25, width 16, height 8 mm.

Type Locality—Gippsland Lakes, Victoria; Kalimnan.

Location of Holotype—Tate Mus. Coll., Univ. of Adelaide, T 1424.

Description of Hypotype—Shell rather small, thin elongate-oval in shape, sides contracted, irregularly sculptured with concentric growth lines and irregular curved radial ridges which, however, are not present on other specimens. Apex pronouncedly spiral, subcentral, small separated from the margin, and curved to the left. Septum small, deeply set, margin broken in hypotype but otherwise slightly concavely curved.

Dimensions—Length 18, width 9, height 6 mm.

Locality—Abattoirs Bore.

Location of Hypotype—Tate Mus. Coll., Univ. of Adelaide, F 15173.

Observations—Three specimens are available from Adelaide material and all show the conspicuously spiral apex which is set in from the margin slightly to the left of the centre.

Material—The hypotype and one specimen, Abattoirs Bore; one specimen and three juvenile specimens, Weymouth's Bore.

Stratigraphical Range—Miocene-Dry Creek Sands.

Geographical Distribution—Gippsland, Vic.-Adelaide, South Australia.

Crepidula (Zeacrypta) hainsworthi Johnston

pl. 4, figs. 13, 14.

Crepidula hainsworthi Johnston, 1885, Proc. Roy. Soc. Tas. for 1884, p. 233, pl. figs. a-c; 1888, Geol. Tas., pl. 32, fig. 13; Tate, 1893b, Trans. Roy. Soc. S. Aust., 17, p. 330; Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., 1 (2), p. 113; Ludbrook, 1941, Trans. Roy. Soc. S. Aust., 65 (1), p. 100.

Diagnosis—A narrow, high *Crepidula*, with basal outline elongate-oval. Apex strongly hooked, posterior, projecting beyond the posterior margin.

Dimensions—Length 14, breadth 8, height 5·5 mm.

Type Locality—Table Cape, Tasmania.

Location of Holotype—? Hobart Museum.

Observations—This is a very distinctive species with its high apex downwardly recurved outside the posterior margin. None of the Adelaide examples show any evidence of there being a flat form of the species, but according to the author, "The younger examples differ very much in appearance from the mature forms, being relatively shallower and scarcely beaked", from which it may be assumed that the flatter variety does occur.

Material—The figured hypotype and 6 specimens, Abattoirs Bore; five specimens and one fragment, Weymouth's Bore.

Stratigraphical Range—? Oligocene and Dry Creek Sands.

Geographical Distribution—Table Cape, Tas.; Adelaide, South Australia.

Family STRUTHIOLARIIDAE.

Genus TYLOSPIRA Harris, 1897.

Tylospira Harris, 1897, Cat. Tert. Moll. Brit. Mus., 1, p. 222.

Type species (o.d.) *Buccinum scutulatum* Martyn.

Tylospira coronata marwicki (Finlay)

pl. 1, figs. 6, 7.

Pelicaria coronata Tate, 1890a, Trans. Roy. Soc. S. Aust., 13 (2), p. 176.
Tylospira coronata Tate, Dennant & Kitson, 1903, Rec. Geol. Surv. Vic., 1 (2), p. 144.

Pelicaria marwicki Finlay, 1931, Trans. N.Z. Inst., **2** (1), p. 17.
Pelicaria howchini Cotton, 1934, S. Aust. Nat., **16** (1), p. 7.
Tylospira coronata marwicki (Finlay), Ludbrook, 1941, Trans. Roy. Soc. S. Aust., **65** (1), p. 89.

Diagnosis—A *Tylospira* with a somewhat short spire, generally two-ninths of total height of shell. Spire whorls convex to subangulate at first, becoming angulate by the third whorl. Early whorls sculptured with nine spiral lirae, with a row of small peripheral nodules developing on the angle of the whorl. Apertural callus thick, spreading over body whorl and up to three-quarters of penultimate whorl.

Description of Hypotype—Shell acuminately ovate, with a moderately acute, relatively small spire. Protoconch missing, adult whorls six, moderately rapidly increasing, convex to subangulate at first, but angulate by the third whorl; body whorl large, seven-ninths total height of shell, slightly depressed between suture and shoulder. Suture widely but not deeply canaliculate. Sculpture on early whorls of about nine spiral lirae and a row of small peripheral nodules gradually developing on the angle of the whorl. Callus enamel spreading over body whorl and three-quarters of penultimate whorl. Aperture elongate-oval, angulate both posteriorly and anteriorly. Outer lip thickened but not variced, broadly V-shaped in profile, arched to the left medially. Columella smooth, concave, strongly arcuate. Growth lines on callus strong and sigmoid, following the profile of the outer lip but terminating at the pad of smooth, thicker callus spreading back from the columella.

Dimensions—Height 45, diameter 31, height of body whorl 35, height of aperture 24 mm.

Type Locality—Abattoirs Bore.

Location of Holotype—Finlay Collection, New Zealand.

Location of Hypotypes—Tate Mus. Coll., Univ. of Adelaide, F 15174.

Observations—The writer (also 1941, p. 89) considers this a geographical subspecies of the restricted Kalimnan *Tylospira coronata* (Tate). The subspecies has never been completely described or figured. Finlay (1931, p. 17) differentiated it as a separate species on differences exhibited by what was evidently an incompletely developed shell, and Cotton based his species *howchini* on an eroded shell, also rather immature, on which the sculptured features were almost unrecognizable. Figured here (pl. 1, fig. 7) is the hypotype described above, of the same size and approximate dimensions as Tate's holotype of *T. coronata* s. str. Figured also (pl. 1, fig. 6) is a younger specimen showing the features on which the Adelaide shell was separated specifically by Finlay and later by Cotton. The adult specimen is less conspicuously sulcate than *coronata* s. str. and the later spire whorls are less angulate and nodulose, but the early spire whorls are the same in both species and there is no difference in the body whorl; the growth lines and outer lip are not, as stated by Finlay, "far more sigmoid". The measurements of the adult shell are so nearly like those of the holotype that one cannot accurately describe it as "more squat".

Material—Nine specimens, Hindmarsh Bore; for comparison, 9 topotypes of *coronata* s. str., Muddy Creek, Victoria; 4 specimens, Gippsland, Victoria; B.M. Collection.

Stratigraphical Range (of species)—Kalimnan-Dry Creek Sands.

Geographical Distribution—Gippsland, Vic.-Adelaide, South Australia.

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EXPLANATION OF PLATES

PLATE 1

Fig. 1.—*Thericium* (*Chavanicerithium*) *torri* (Tate). Hypotype, juvenile, F 15175, x 1·3.
Fig. 2.—*Thericium* (*Chavanicerithium*) *torri* (Tate). Hypotype, F 15176, Abattoirs Bore, x 1·3.
Fig. 3.—*Thericium* (*Chavanicerithium*) *adelaidensis* (Hawchin & Cotton). Hypotype, Hindmarsh Bore, 450-485 feet, F 15178, x 1·3.

Fig. 4.—*Diastoma provisi* Tate. Holotype, Dry Creek Bore, T 1541, x 2.
Fig. 5.—*Thericium (Thericium) fallax* (Ludbrook). Hypotype, Bore Hundred of Munno Para Sec. 4251, 238-256 feet, x 1·3.
Fig. 6.—*Tylospira coronata marwicki* Finlay. Hypotype, immature specimen, Hindmarsh Bore, 450-485 feet, x 2/3.
Fig. 7.—*Tylospira coronata marwicki* Finlay. Hypotype, Hindmarsh Bore, 450-485 feet, x 2/3.

PLATE 2

Fig. 1.—*Turritella (Colpospira) platyspiroides* sp. nov. Holotype, Abattoirs Bore, x 3.
Fig. 2.—*Turritella (Colpospira) platyspiroides* sp. nov. Paratype, Abattoirs Bore, x 3.
Fig. 3.—*Valsantia spectabilis* sp. nov. Holotype, Hindmarsh Bore, x 10.
Fig. 4.—*Architectonica wannonensis* (T. Woods). Hypotype, Weymouth's Bore, apical view, x 7.
Fig. 5.—. . . . . lateral view, x 7.
Fig. 6.—*Ataxocerithium bidenticulatum* sp. nov. Holotype, Weymouth's Bore, x 4; protoconch, x 12.
Fig. 7.—*Ataxocerithium bidenticulatum* sp. nov. Paratype a, x 4; protoconch of paratype b, x 12.
Fig. 8.—*Bittium (Semibittium) subgranarium* sp. nov. Holotype, Hindmarsh Bore, x 10.
Fig. 9.—*Semivertagus capillatus* Tate. Hypotype, Hindmarsh Bore, x 3.
Fig. 10.—*Hypotrochus semiplicatus* sp. nov. Holotype, Weymouth's Bore, x 5.
Fig. 11.—*Cerithiella (Coxellaria) trigemmata* Chapman & Crespin. Hypotype, Brown Coal Shaft, Altona, Victoria, x 6.
Fig. 12.—*Cerithiella (Coxellaria) superspiralis* sp. nov. Holotype, Abattoirs Bore, x 5.
Fig. 13.—*Seila (Notoseila) triplanicincta* sp. nov. Holotype, Abattoirs Bore, x 3·3.
Fig. 14.—*Seila (Notoseila) triplanicincta* sp. nov. Paratype, Hindmarsh Bore, x 5.
Fig. 15.—*Triphora (Isotriphora) salisburyensis* sp. nov. Holotype, Weymouth's Bore, x 6. a. Protoconch of paratype, x 40.
Fig. 16.—*Triphora (Notosinister) praegranifera* sp. nov. Holotype, Weymouth's Bore, x 10. a. Protoconch x 20.

PLATE 3

Fig. 1.—*Amaea (Amaea) triplicata* (Tate). Hypotype, Hindmarsh Bore, x 3.
Fig. 2. *Leiostraca (Leiostraca) acutissima* Sowerby. Hindmarsh Bore, x 4.
Fig. 3.—*Niso psila*, T. Woods. Hypotype, Weymouth's Bore, x 4.
Fig. 4.—*Syrnola tincta* Angas. Hypotype, Weymouth's Bore, x 6.
Fig. 5.—*Syrnola (Agatha) praefasciata* sp. nov. Holotype, Weymouth's Bore, x 6.
Fig. 6.—*Syrnola (Agatha) jonesiana* (Tate). Hypotype, Weymouth's Bore, x 6.
Fig. 7.—*Syrnola (Agatha) infrasulcata* (Tate). Hypotype, Weymouth's Bore, x 4.
Fig. 8.—*Syrnola (Puposyrnola) tasmanica* T. Woods. Hypotype, Muddy Creek, x 10.
Fig. 9.—*Syrnola (Evelynella) adelaidensis* sp. nov. Holotype, Hindmarsh Bore, x 7.
Fig. 10.—*Turbonilla (Turbonilla) mariae* T. Woods. Hypotype, Hindmarsh Bore, x 10.
Fig. 11.—*Turbonilla (Chemnitzia) mappingae* sp. nov. Holotype, Weymouth's Bore, x 8.
Fig. 12.—*Turbonilla (Chemnitzia) wurrongae* sp. nov. Holotype, Hindmarsh Bore, x 7.
Fig. 13.—*Turbonilla (Chemnitzia) adelaidensis* sp. nov. Holotype, Weymouth's Bore, x 5. Protoconch, x 15.
Fig. 14.—*Turbonilla (Chemnitzia) widningae* sp. nov. Paratype, x 6.
Fig. 15.—*Turbonilla (Chemnitzia) widningae* sp. nov. Holotype, Hindmarsh Bore, x 6.
Fig. 16.—*Turbonilla (Chemnitzia) currongae* sp. nov. Holotype, Hindmarsh Bore, x 2. Protoconch, x 20.

PLATE 4

Fig. 1.—*Hipponix (Sabia) conicus* (Schumacher). Holotype, Recent. x 1·5. British Museum photo.
Fig. 2.—. . . . . x 1·5. British Museum photo.
Fig. 3.—*Hipponix (Sabia) conicus* (Schumacher). Hypotype, Hindmarsh Bore, x 4.
Fig. 4.—. . . . . x 4.
Fig. 5.—*Capulus circinatus* Tate. Hypotype, Abattoirs Bore, x 4.
Fig. 6.—. . . . . x 4.
Fig. 7.—*Calyptraea (Sigapatella) crassa* Tate. Hypotype, Hindmarsh Bore, x 3.
Fig. 8.—. . . . . x 3.
Fig. 9.—*Crepidula (Zeacrypta) immersa* Angas. Hypotype, convex variety, Hindmarsh Bore, x 1.
Fig. 10.—*Crepidula (Zeacrypta) immersa* Angas. Hypotype, flat, curved variety, Hindmarsh Bore, x 1.
Fig. 11.—. . . . . x 1.
Fig. 12.—*Crepidula dubitabilis* Tate. Hypotype, Abattoirs Bore, x 1·5.
Fig. 13.—*Crepidula (Zeacrypta) hainsworthi* Johnston. Hypotype, Abattoirs Bore, x 1·3.
Fig. 14.—. . . . . x 1·3.